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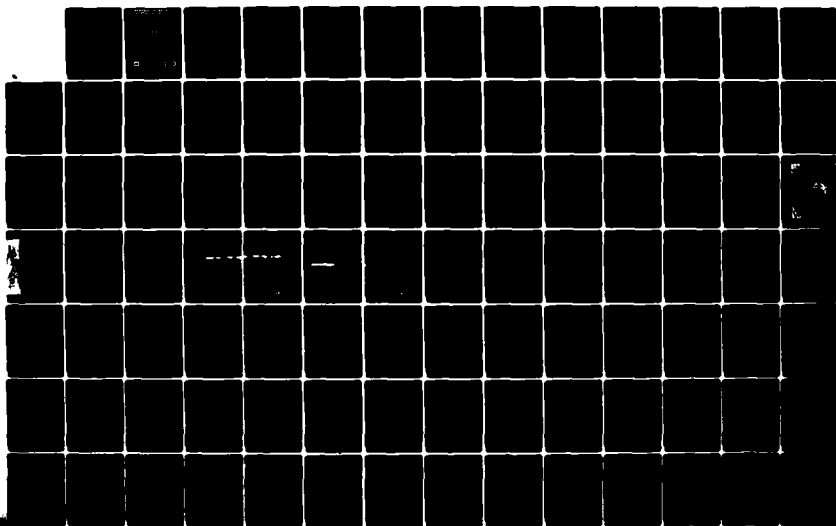
EMBANKMENT CRITERIA AND PERFORMANCE REPORT SALT CREEK
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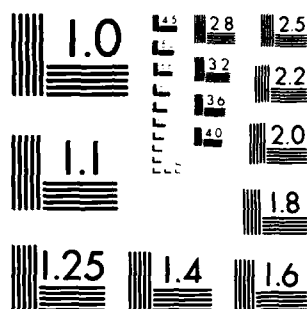
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EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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SALT CREEK AND TRIBUTARIES, NEBRASKA

SITE 18

BRANCHED OAK DAM AND LAKE

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SALT CREEK AND TRIBUTARIES

BRANCHED OAK DAM AND LAKE

SITE 18

RAYMOND, NEBRASKA

EMBANKMENT CRITERIA AND PERFORMANCE REPORT



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PREPARED BY: UNITED STATES ARMY
CORPS OF ENGINEERS
OMAHA DISTRICT

**SALT CREEK AND TRIBUTARIES
BRANCHED OAK DAM AND LAKE
SITE 18
RAYMOND, NEBRASKA**

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

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**PERTINENT DATA
SITE 18**

1. Reservoir Data

Drainage Area	88.7 square miles
Permanent Pool Area	1,800 acres at El.1284.0 (Conservation Pool)
Sediment Storage	13,250 acre-feet
Flood Control Capacity Below Spillway Crest	14.9 inches of runoff

2. Embankment

Type	Homogeneous rolled fill
Crest Elevation	1320.0 feet m.s.l.
Maximum Height above Streambed	80 feet
Height above Valley Floor	68 feet
Crest Width	32 feet
Crest Length	Approximately 5,200 feet
Slope Protection	Grass
Wave Erosion Protection	Riprap
Seepage Control	Pervious vertical drain with intermittent outlets
Compacted Fill Quantities	Approximately 2,524,400 cubic yards
Berm Fill Quantities	Approximately 297,400 cubic yards

3. Emergency Spillway

Type	Uncontrolled, grassed, earth channel
Side Slopes	1V on 3H
Crest Elevation	1311.0 feet m.s.l.
Crest Length	300 feet
Width (Bottom)	200 feet
Length	Approximately 1,900 feet
Excavation	Approximately 607,000 cubic yards

4. Borrow

Quantity	Approximately 2,147,000 cubic yards
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5. Outlet Works

Type Inlet	Concrete Drop
Service Gate	4'x6' Vertical Lift, Hand Operated, Bottom Elevation 1274.0 feet m.s.l.
Conservation Pool Outlet	2 - 3.5'x12', 1284.0 feet m.s.l.

5. Outlet Works Cont'd

Water Rights Gate	10" Diameter Vertical Lift, Hand Operated, Bottom Elevation 1276.3 feet m.s.l.
Conduit Type, Size, and Length	1 - 72" Ø RCP x 408' long
Seepage Control	Five Seepage Diaphragms
Stilling Basin	Saint Anthony Falls Type
Outlet Channel	
Length	1,100 feet
Excavation Quantity	91,000 cubic yards
Discharge Capacity	
@ Pool El. 1311.0 feet m.s.l.	1,320 c.f.s.

6. Downstream Discharges. Assuming the service outlet is 50 percent operative, the maximum discharge downstream from the reservoir would be 660 c.f.s. for the Reservoir Design Flood, which is well within the bankfull capacity of 2,700 c.f.s. In the event of a probable maximum flood occurrence, the maximum outflow would be 4,800 c.f.s. and would exceed the downstream capacity for a period of several days.

7. Pertinent Storage Levels.

<u>Feature</u>	<u>Elevation Ft. MSL</u>	<u>Area Acres</u>	<u>Storage A.F.</u>
Top of Dam	1320.0	4,460	133,966
Embankment Design Flood	1317.3	4,207	122,283
Spillway Crest	1311.0	3,640	97,556
Reservoir Design Flood	1295.1	2,466	49,491
Conservation Pool	1284.0	1,780	25,994
Sediment Pool	1275.7	1,272	13,250
Gated Outlet	1274.0	1,160	11,224

The 100-year sediment allowance is 13,250 acre-feet. This is an average depth of 2.8 inches over the basin.

8. References. For additional information and description on the construction background, operational data, or procedures regarding this dam and lake, reference is made to the "Branched Oak Dam and Reservoir, Operation and Maintenance Manual," dated July 1981; "Design Memorandum No. MSC 20, Branched Oak Dam and Reservoir," dated June 1965; "Periodic Inspection Reports," dated July 1968, September 1969, November 1970, July 1972, October 1974 and October 1979; and "Plans and Specifications for Branched Oak Dam and Reservoir," March 1966.

**SALT CREEK AND TRIBUTARIES
BRANCHED OAK DAM AND LAKE
SITE 18
RAYMOND, NEBRASKA**

EMBANKMENT CRITERIA AND PERFORMANCE REPORT

1. INTRODUCTION.

1.1. **Purpose of Report.** This report provides a summary record of significant design, construction, and operational data on Branched Oak Dam for use by engineers to familiarize themselves with the project, reevaluate the embankment when unsatisfactory performance occurs, and provide guidance for designing comparable future projects. It was prepared in accordance with MRD-R 1110-1-8, subject: "Construction Foundation Reports and Embankment Criteria and Performance Reports," dated 27 February 1978 and ER 1110-2-1901, subject: "Embankment Criteria and Performance Reports," dated 31 December 1981.

1.2. **Authorization and Purpose of Project.** Project authorization was provided by Public Law 85-500, 85th Congress, commonly referred to as the "Flood Control Act of 1958." Authority was granted to construct a flood control project on Salt Creek and Tributaries, Nebraska, essentially in accordance with the report of the Chief of Engineers contained in House Document 396, 84th Congress, 2nd Session. Branched Oak Dam is one of the features of the authorized project. The dam was designed and constructed by the Corps of Engineers as part of a system of 10 dams and reservoirs on the tributaries of Salt Creek above the City of Lincoln, Nebraska, for flood control, fish and wildlife conservation, and recreation. The permanent pool is maintained and operated for fish and wildlife conservation and recreation by the State of Nebraska Game and Parks Commission for public use.

1.3. **Location and Description of Project.** Branched Oak Dam is located in the southeastern part of Nebraska in Lancaster County, approximately 4 miles west of Raymond, Nebraska. See the Project Location Map, Plate A1,

Appendix A. The main features of the dam consist of an earth embankment, grassed emergency spillway, and concrete outlet works structure. These are located as shown on Plates A2, A3, and A4. Aerial views of the completed project are shown on Plates B1 and B2, Appendix B.

1.4. Project Maintenance. Major repairs of the embankment, spillway, outlet works and discharge channel are the responsibility of the Corps of Engineers. The Nebraska State Game and Parks Commission is responsible for routine maintenance, such as repair of minor slope erosion, control of burrowing animals, and maintenance of grass cover. The State is also responsible for maintaining the conservation pool for fish and wildlife conservation and for recreational purposes.

1.5. History of Project Design.

1.5.1. Survey Report. The initial recommendations for construction of a system of dams on tributaries of the Salt Creek were made in the "Survey Report on Flood Control for Salt Creek and its Tributaries, Nebraska and its Supplements" dated January 1953. This report formed the basis for Congressional authorization.

1.5.2. General Design. In December 1960, the "General Design Memorandum," No. MSC-1, was submitted to higher authority. The report updated the survey report in terms of economic feasibility and provided an overall general design of the multi-dam Salt Creek Project.

1.5.3. Final Design. Final design of Branched Oak Dam (Site 18) is covered in Design Memorandums MSC-20, Branched Oak Dam and Reservoir, and MSC-20, Supplement A, Revised Section V - Earthwork. These reports present detailed designs of the earth embankment, emergency (earthen) spillway, outlet works, and the necessary bridge, road, and utility alterations.

1.6. History of Project Construction. Branched Oak Dam was constructed by contract, under the supervision of the Corps of Engineers, Omaha District. Contract No. DA25-066-CIVENG-66-0127, Branched Oak Dam and Reservoir, was advertised on 1 March 1966 and bids were opened 7 April 1966. Brandt Construction Incorporated and John H. Brandt (in a joint venture) were awarded the contract. The contract bid was \$1,447,604, which was \$231,194 below the Government Estimate. Final payment though, amounted to \$1,459,017 due to modifications to the contract and payment of actual quantities.

Work on the project was ordered to proceed by 10 May 1966, and was completed in two construction seasons, with a final completion date of 31 December 1967. In the first construction season (August 1966 to November 1966), the contractor was required to complete the outlet works intake structure to elevation 1280.0, and the right and left abutment sections of the dam embankment to a minimum elevation of 1272.0. Also, from a point 200 feet right to 200 feet left of centerline of the outlet works, (Sta. 39+20 to 43+20), the crest was to be constructed to elevation 1320.0. The purpose of this was to obtain practically all of the foundation settlement under the conduit pipe and the intake structure prior to the start of the second construction season (April 1967 to November 1967). Closure, seeding, completion of the embankment, and remaining work was completed during the second construction season.

Additional improvements to the dam, since its original construction, are discussed in section 10.4. in this report.

2. GEOLOGY. The Salt Creek drainage basin is located primarily in Lancaster County in eastern Nebraska and lies entirely within the Dissected Till Plains Section of the Central Lowlands Physiographic Province. Pleistocene and Pliocene deposits of glacial, interglacial and eolian origin overlie bedrock, which is at a maximum depth of over 200 feet, although in some localized areas, the bedrock occurs at relatively shallow depths.

Bedrock under the greater portion of the basin is the Dakota Group sandstone and shales of Cretaceous age, with some Permian limestone and shales in the southeastern portion of the basin and Pennsylvanian limestone and shales in the northeastern portion of Lancaster County. In the damsite area, a typical section of the deposits in descending order are as follows: Peorian Loess Formation, Loveland (loess-clay) Formation, Kansan Glacial Drift, Aftonian (interglacial) Formation, the Grand Island Formation, the Seward Formation, and the Nebraskan Glacial Drift. In general, the Salt Creek basin is an eroded and dissected till plain which was covered by two eolian deposits, the Loveland (loess-clay) Formation and the Peorian Loess Formation. Post-Loveland erosion removed most of the Loveland and the remaining Loveland was subsequently covered by the younger Peorian Loess. In many places, especially in the western half of the basin, all the loess, both the Loveland and Peorian, was removed by erosion exposing the underlying glacial drift. In a few local areas, notably in the eastern part of Seward County, southcentral and northeastern part of Lancaster County, and southeast part of Saunders County, all of the Pleistocene deposits have been removed by erosion exposing the underlying bedrock.

3. FOUNDATION INVESTIGATION.

3.1. Subsurface Exploration. A total of 79 borings, 20 to 100 feet deep, were drilled to determine soil characteristics for general and specific design studies of this site. These consisted of 19 borings within the floodplain alluvium foundation area, 29 borings within spillway and abutment areas, 16 borings within possible borrow areas, and 15 borings within possible recreation development areas. The locations and identifying numbers of these borings are shown on Plate A4. Disturbed moisture and classification samples were taken from each boring at every change in material and at intervals not greater than 5 feet in depth. Disturbed sack samples were taken of representative spillway and borrow area materials, and undisturbed Shelby samples were taken of representative embankment foundation materials. Standard

penetration tests were also taken at those borings which were within the embankment flood plain foundation and outlet works areas. Logs of the borings are shown on Plates A6 through A15.

3.2. Foundation Conditions. The valley foundation soils at this site consisted primarily of clay alluvium derived from Kansan and Nebraskan glacial drift clay, and from Aftonian formation silts and sands, and clay silt loess. The alluvium underlain by the Grand Island and Seward Formations, was primarily classified as lean, sandy, and fat clay (CL and CH). In the left abutment and spillway area, in descending order, the soils were composed of a loess mantle, Kansan drift, and Nebraskan drift. The loess was classified as lean and sandy clay and silt (CL, CH, and ML). It was described as stiff and medium dense, moist and brown, and about 20 feet thick. The Kansan drift was classified primarily as lean and sandy clay (CL and CH) with some sand and was about 30-40 feet thick. It was described as medium stiff to stiff, moist, red-brown and brown. The Nebraskan drift was classified as fat and sandy clay and silt (CH, CL, and ML). It was described as very stiff to hard, moist to wet and gray in color. In the right abutment the loess mantle was absent and the Aftonian formation was present between the Kansan and Nebraskan drift. It was described as stiff, medium dense, moist, light gray, and was classified as silt (ML). The general soil and geologic profile is shown on Plate A5. Specific soil characteristics and laboratory classification within definite areas are shown on the subsequent plates of boring logs Nos. A6 through A15.

4. FOUNDATION PREPARATION. Before work began, all vegetation, such as brush, heavy sod, heavy growth of grass, and all decayed vegetable matter, rubbish, road surfacing, and other unsuitable material within the area upon which fill was to be placed was required to be removed. After completion of the clearing and stripping, all depressions were filled and steep slopes flattened. After filling the depressions, and immediately prior to the placement of embankment fill, the foundation was required to be loosened thoroughly by

scarifying, plowing, or harrowing to a depth of 4 inches. After the removal of roots or other debris turned up in the loosening process, the foundation was compacted in preparation for placement of fill material.

5. EMBANKMENT. A discussion of the design and construction of the embankment is presented in the following sections. It includes a description of the embankment section and materials, the design shear strengths, stability analyses, seepage control, and general construction of the embankment.

5.1. Embankment Section. The embankment is a rolled, homogeneous, impervious earthfill with a pervious embankment drain consisting of a continuous vertical drain with intermittent horizontal outlets. It has a crest length of 5,200 feet and a crest width of 32 feet. It is 68 feet high and has a crest elevation of 1320.0 feet m.s.l.

The slopes of the embankment are as follows:

Upstream

1 on 3, 1 on 5, 1 on 3	1300-1320
1 on 3	1280-1300
1 on 10	1265-1280
1 on 3	ground-1265

Downstream

1 on 3	1288-1320
1 on 5	ground-1288

See Plates A16 and A17 for typical embankment sections and details, and Plates B3 and B4 for views of the embankment slopes and crest.

5.2. Embankment Materials.

5.2.1. Earthfill. The embankment was constructed primarily of loess and glacial drift material from spillway excavation, abutment area

borrow, and alluvium from upstream borrow. This material provided a relatively impervious embankment section consisting of 2,524,400 cubic yards of homogeneous rolled earth fill and an additional 297,400 cubic yards of fill in the upstream berm.

5.2.2. Embankment Drain Filter Material. The embankment drain filter material consisted of washed sand, gravel, or crushed stone well graded between the following limits:

<u>Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4 inch	100
No. 4	75-95
No. 16	45-70
No. 200	0-5

5.2.3. Slope Protection. Wave action on the upstream face of the embankment, in the range of the permanent pool, is dissipated on 20 inches of riprap, placed on 6 inches of spalls, which is placed over 6 inches of bedding. Other embankment and excavation slopes are protected by a grass cover, except for the LV on 10H slope of the upstream berm, between elevation 1270 and 1280 which is protected by a 12-inch layer of gravel. See Plate A17 and Plates B5 and B6 for sections, details, and views of the slope protection.

5.2.3.1. Riprap. Riprap wave protection on the embankment and around the intake structure is a quarried limestone, and specifications required it to be free of thin slabby pieces and be reasonably well-graded between the following limits:

<u>Weight per Stone</u>		<u>Percent of Total Weight</u>
<u>Type A</u>	<u>Type B</u>	<u>Lighter than or Passing</u>
800 lbs.	50 lbs.	100
200 lbs.	20 lbs.	35-55
20 lbs.	5 lbs.	0-10

Quality testing of the riprap material consisted of Bulk Specific Gravity, Soundness in Magnesium Sulfate, and Soundness in Freezing and Thawing.

Type A riprap was used between elevations 1280.0 and 1300.0 and was underlined by 6 inches of spalls placed on 6 inches of bedding material. Type B riprap was used for the outlet works and was underlined by 6 inches of bedding material.

5.2.3.2. Spalls. The spalls were to be at least equal in quality of the stone used for riprap and reasonably well-graded within the following limits:

<u>Sieve Size</u>	<u>Percent by Weight Passing</u>
4 inch	100
1-1/2 inch	55-85
3/4 inch	30-65
No. 4	0-10

5.2.3.3. Bedding. The 6-inch bedding layer used beneath the riprap and spalls consisted of sand and gravel and was required to be reasonably well-graded between the following limits:

<u>Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4 inch	100
No. 4	80-95
No. 16	55-80
No. 200	0-10

5.2.3.4. Gravel Surfacing. The 1V on 10H upstream slope is protected by a 12-inch layer of gravel. The material consisted of sand and gravel and was required to be reasonably well-graded within the following limits:

Sieve Size

Percent by Weight Passing

3/4 inch	100
No. 4	80-95
No. 16	55-80
No. 200	0-20

5.3. Embankment Placement.

5.3.1. General. Specifications required the gradation and distribution of materials throughout the earthfill section of the dam be such that the embankment would be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material.

5.3.2. Compacted Embankment Fill. The more impervious fill materials were placed toward the upstream section of the embankment, and the more pervious of the fill materials were placed toward the downstream section of the embankment, so that a transition in permeability was affected from the upstream to the downstream portions of the embankment.

After dumping, the material was spread in approximate horizontal layers over fill areas. The layers were 6 inches thick or less after compaction and had moisture contents ranging from 2 percent above optimum to 4 percent below. Before compaction, each layer of fill was harrowed, if needed, to break up and blend materials and to obtain uniform moisture content. If one pass of the harrow did not break up or blend the materials sufficiently, additional passes were performed, but no more than three passes were required. Each 6-inch layer of material was compacted to at least 95 percent of the maximum density as determined by the Standard AASHTO method, T99, Method D. Portions of the fill which could not be compacted with rollers because of space restrictions, were placed in 4-inch loose lift layers and compacted with power tampers to the same degree of compaction as that obtained on other portions of the fill.

During construction, over 1,100 field compaction control tests were taken during the periods of August 1966 to November 1966 (1st Construction season), and April 1967 to November 1967 (2nd Construction season). A summary of the tests is given in the following table.

- SUMMARY OF FIELD COMPACTION CONTROL TESTS -

TYPE TEST	RANGE	MOST PREDOMINANT
MAXIMUM DRY DENSITY (PCF)	95.2 - 120.0	100.1 - 104.7
PERCENT COMPACTION	94.2 - 111.0	97.0 - 102.4
OPTIMUM WATER CONTENT (%)	12.2 - 24.5	17.0 - 22.3
LIQUID LIMIT	14 - 63	40 - 50
PLASTIC INDEX	7 - 46	22 - 29

5.3.3. Embankment Berm Fill. The embankment berm was constructed of borrow area materials in 12 inch thick layers. Compaction was accomplished by the controlled movement of the construction equipment over the fill in such a manner as to obtain the maximum amount of evenly distributed compaction possible. Moisture control was not required except that the upper limit of the moisture content was that which permitted the movement of construction equipment.

5.3.4. Embankment Drain Filter Material. The filter material was placed in 8 inch thick layers and each layer was thoroughly compacted by vibratory plate compactors. The material was placed by methods which eliminated the mixing of earth and the filter material. Filter material

found to be dirty or otherwise contaminated was removed and replaced at no cost to the government.

5.3.5. Slope Protection Placement.

5.3.5.1. Riprap. The riprap was placed on the spall and bedding layers so as to produce a reasonably well-graded mass of rock with a minimum percentage of voids. A tolerance of plus or minus 4 inches from the required slope lines and grades was allowed, except that either extremes of such tolerance was not to be continuous over an area greater than 200 square feet. The riprap was placed to its full course thickness in one operation and in such a manner as to avoid displacing the spall layer and to minimize segregation of the riprap. The desired distribution of the various sizes of stones throughout the mass was obtained by selective loading of the material at the quarry site and by controlled dumping. All stone was required to be placed by means of a clam, orange peel, or skip box. Dumping of stone at the top of the slopes and rolling or pushing them into place was not permitted.

5.3.5.2. Spalls. Specifications required that the spalls be placed on the bedding layer by methods which would obtain the best possible graded mass of uniform thickness. A tolerance of plus or minus 1 inch was permitted in areas not exceeding 200 square feet.

5.3.5.3. Bedding. The bedding material was spread uniformly on the prepared base by methods which did not cause segregation of particle sizes within the bedding. Compaction of the bedding layer was not required, but it was finished to present a reasonably even surface. The average thickness was required to be within plus or minus 1 inch from the required thickness within areas not exceeding 100 square feet.

5.3.5.4. Gravel Surfacing. Specifications required placing of the gravel in a manner which would prevent segregation of particle sizes. The material was placed in one layer and compacted by one complete pass of a crawler type tractor weighing not less than 20,000 pounds.

5.4. Embankment Settlement. A total foundation settlement of approximately 3.52 feet was estimated to occur at the maximum embankment section. In computing the settlement, a maximum embankment section of 68 feet high was considered to bear on 42 feet of compressible valley alluvium. This compressible material was divided into a 6-foot top stratum of medium stiff to stiff, primarily lean clay, above a 36-foot thick soft to medium stiff stratum of lean, sandy, and fat clay.

Time settlement studies indicated that approximately 70 percent of consolidation would occur during construction and the remaining 30 percent would occur at a diminishing rate over an indefinite period. The embankment was provided with a 1-foot overbuild to compensate for the continuing settlement. Total foundation settlement to date has been 3.85 feet, of which 3.40 feet occurred during construction. The 1-foot overbuild was therefore sufficient, since only 0.45 feet of settlement has occurred since construction. Foundation settlement gauges indicate that the rate of settlement has leveled off and is now negligible.

5.5. Laboratory Testing. Laboratory tests were performed on representative disturbed and undisturbed samples. These tests consisted of the following: (1) mechanical analyses, Atterberg limits, and moisture determinations, (2) compaction tests, (3) consolidation tests, (4) triaxial compression tests, "Q" and "R," and (5) direct shear "S" tests. Laboratory results for the above tests are given on Plates A18 through A25, and a discussion of the triaxial compression and direct shear tests is given below.

5.5.1. Triaxial Compression Tests. Twenty-three series of triaxial compression tests, "Q" and "R," were performed on undisturbed samples of alluvium foundation and remolded embankment material, and are discussed below.

5.5.1.1. Undisturbed Alluvium Foundation. Eleven series of "Q" tests on alluvial material, along with a study of drill log data,

resulted in the division of the alluvium into strata A and B for "Q" strengths. Stratum A is the top 8-foot thickness. It is stiff, dry to moist, primarily lean clay. Stratum B consisted of 31 feet of alluvium that ranged from soft to stiff, moist to saturated, silty, sandy, and lean clay, and medium to stiff fat clay. The range in strengths were as follows:

<u>Stratum</u>	<u>Depth-Ft.</u>	<u>Tan ϕ</u>	<u>Coh - T/SF</u>
A	0-8	0.13 to 0.40	0.55 to 1.60
B	8-39	0.0 to 0.03	0.32 to 1.45

Seven series of "R" tests were performed on the alluvium. The alluvium was not divided into strata for "R" strengths. The range in strengths were as follows:

<u>Tan ϕ</u>	<u>Coh - T/SF</u>
0.19 to 0.25	0.15 to 0.60

5.5.1.2. Remolded Embankment Material. Three series of "Q" tests and two series of "R" tests were performed on representative embankment materials remolded at 95 percent of maximum density and 2 percent above optimum moisture. The resulting strengths were as follows:

<u>Test</u>	<u>Sample</u>	<u>Tan ϕ</u>	<u>Coh-T/SF</u>
Q	C-1, Loess	0.11	0.90
Q	C-2, Drift	0.0	1.32
Q	C-3, Alluvium	0.0	1.30
R	C-2, Drift	0.21	0.31
R	C-3, Alluvium	0.23	0.30

5.5.2. Direct Shear Tests. Seven series of direct shear "S" tests were performed on undisturbed alluvium and remolded embankment materials. The strength results were as follows:

<u>Sample Type</u>	<u>Tan ϕ</u>	<u>Coh-T/SF</u>
Undisturbed	0.52	0.20
Undisturbed	0.65	0.0
Undisturbed	0.35	0.38
Undisturbed	0.57	0.10
Remolded (C-1)	0.44	0.40
Remolded (C-2)	0.43	0.40
Remolded (C-3)	0.41	0.0

5.5.3. Adopted Design Values. After evaluating all the test results the following strengths were used in design:

ADOPTED DESIGN VALUES

<u>Material</u>	<u>Unit Weight</u>		<u>"Q" Case</u>		<u>"R" Case</u>		<u>"S" Case</u>	
	<u>T/CF</u>		<u>Coh</u>	<u>Tanϕ</u>	<u>Coh</u>	<u>Tanϕ</u>	<u>Coh</u>	<u>Tanϕ</u>
	<u>Bouyant</u>	<u>Saturated</u>						
Embankment	0.0288	0.06	1.0	-	0.30	0.22	-	0.45
Foundation								
Stratum "A"	0.0288	0.06	1.0	-	0.25	0.21	-	0.50
Stratum "B"	0.0268	0.058	0.45	-	0.25	0.21	-	0.50

5.6. Embankment Stability. Stability analyses were performed on both the downstream and the upstream slopes at the maximum embankment section positioned over the greatest depth of relatively soft foundation.

5.6.1. Method of Analyses. The wedge and circular arc methods of analyses were used. These are patterned after the finite slice method outlined in EM 1110-2-1902, Appendix III, dated 27 December 1960. The analyses were run using the Omaha District RCA 301 Computer. The most critical failure surface was found by trial and each critical case was then checked manually. The computer and manual results were in close agreement.

5.6.2. Design Cases. Embankment stability analyses were performed for the end of construction, steady seepage, partial pool, and sudden drawdown cases. Stability sections and their respective factors of safety for the design cases are shown on Plates A26, A27, and A28.

5.6.2.1. End of Construction. This case was run using both the circular arc and the wedge method of analyses. Instantaneous placement of the embankment was assumed and the computed factors of safety were 1.24 and 1.26 respectively. These factors are slightly lower than the 1.3 specified in EM 1110-2-1902. However, from experience of previous Salt Creek Dams, it was known that during the 2-year construction period the consolidation of the foundation due to the embankment load would result in an increase in strength to the extent that it was felt that the factor of safety would be above 1.5. Therefore, for this case, the values were considered adequate.

5.6.2.2. Steady Seepage Case. The downstream slope was analyzed by the circular arc method assuming the pool at the spillway level and the pervious drain operative. The "R" and "S" shear strengths were used in separate computations to determine a range of stability values. The respective minimum factors of safety were 1.32 and 1.78.

5.6.2.3. Partial Pool. The upstream slope was studied for the critical pool elevation of 1274.0 (low level gated outlet elevation). The saturation line was assumed horizontal at each pool level. The "R" shear strengths were used in the computations and the minimum factor of safety was 1.54.

5.6.2.4. Sudden Drawdown. The upstream slope stability was analyzed assuming instantaneous drawdown from the pool at spillway level, elevation 1311.0, to the permanent pool at elevation 1284.0. The "R" shear strengths were used and the minimum factor of safety was 1.44.

5.6.3. Summary. As can be seen in the following table, all factors of safety considered critical were either very close to or exceeded those required in the stability manual. Those which were less than that required and still considered adequate were the result of engineering judgment and experience with similar situations.

STABILITY ANALYSES

Case	Shear Strength	Minimum Required Factor of Safety	Computed Factor of Safety
End of Construction	Q	1.3	1.24*
Steady Seepage	R	1.4	1.32**
Steady Seepage	S	1.4	1.78
Partial Pool	R	1.5	1.54
Sudden Drawdown	R	1.2	1.44

*See discussion in section 5.6.2.1.

**The 1.32 factor of safety for the "R" strength was considered adequate when bracketed with the higher "S" case factor of safety of 1.78.

5.7. Seepage Control.

5.7.1. Embankment. Seepage through the embankment was considered negligible due to the relatively low permanent pool, the infrequent interval and short duration of higher pools, and because of the impervious nature of the embankment. An embankment seepage control internal drain consisting of 32,583 cubic yards of compacted pervious material, with outlets, prevents eventual saturation of the downstream embankment slope under all normal long term seepage conditions. The drain is 3-feet wide with a top elevation of 1311.0 (Spillway Crest Elevation). It is located 10 feet downstream from the embankment centerline and has outlets at 50-foot intervals throughout the embankment section. See Plate A16 for typical sections of the embankment drain.

5.7.2. Foundation. An analysis of foundation seepage was made using a method developed by Mr. P. T. Bennett and published in the proceedings of ASCE Vol. III, 1946, entitled, "The Effect of Blankets on Seepage Through Pervious Foundations." The analysis was performed at the maximum embankment section with a pool elevation of 1311.0 (Spillway Crest

Elevation). The depth of the semi-impervious blanket was assumed to be 40 feet and extend infinitely both upstream and downstream. The depth of the pervious sand was considered as 20 feet. In determining the effective length of semi-impervious blanket, ratios of coefficients of permeability of blanket to that of underlying sands (K_f/K_b) were assumed as 1,000 upstream and 800 downstream. A gradient factor of safety of 1.63 was obtained at the downstream toe of the embankment. The minimum allowable gradient factor of safety was 1.5, therefore, underseepage control (such as relief wells) was not required.

5.7.3. Abutment. Seepage was not considered a problem because of the adequate impervious cover which exists over the sands in the abutments.

5.8. Diversion and Closure. A system of temporary dikes and channels as shown on Plate A29, were used to divert the stream flows into a temporary channel constructed through the embankment area. Specifications required the embankment closure section to be constructed to elevation 1274.0 within 6 days after the start of closure operations and to elevation 1288.0 within 10 days. The embankment at elevation 1288.0 then provided sufficient pool volume to contain the runoff from a 100-year flood occurrence probability with about 5 feet of freeboard.

6. EMERGENCY SPILLWAY. The emergency spillway is a grass-lined, uncontrolled, earth cut channel. It is located in the left abutment, approximately 2100 feet from the embankment. It has a slightly-curved alignment, is 200-feet wide, and 1900-feet long. The spillway has a 300-foot long flat crest at elevation 1311.0 at its upstream entrance, and a 0.2 percent downstream bed slope. Side slopes are 1V on 3H. Total spillway excavation was approximately 607,000 cubic yards. The spillway plan and section are shown on Plate A30, and views of the spillway are shown on Plates B6 and B7.

As stated in General Design Memorandum, MSC-1, "Salt Creek and its Tributaries," the spillway channel must be wide enough to pass the Standard

Project Flood routed 5 days after a Reservoir Design Flood (5 inches of runoff), with outlets assumed to be 50 percent operative and spillway velocities not to exceed 8 feet per second. The 8 feet per second limiting velocity was established as the velocity below which serious erosion would not occur. This criteria was far exceeded since the Standard Project Flood routed in the above manner would fail to reach the spillway crest by more than 10 feet.

7. OUTLET WORKS. The outlet works consist of an intake structure, conduit, stilling basin, and outlet channel. Sections and details of the outlet works are shown on Plates A31 through A39 and views of these structures are shown on Plates B7 through B10.

7.1. Intake Structure. The intake structure is a reinforced concrete box shaft with 6-foot by 12-foot inside dimensions and is commonly referred to as a drop inlet structure. The structure has a 4-foot by 6-foot manually operated gated opening located in the upstream side with a crest elevation of 1274.0. The purpose of the gated opening is to lower the level of the conservation pool in order to inspect the conduit, make shoreline repairs, and control fish population. A water rights gate was recently constructed into the intake structure and is used to release water for downstream needs. See section 10.4.4. in this report for more information concerning the water rights gate. There are also two ungated openings in the intake structure, each 3.5 feet by 12.0 feet with crest elevations of 1284.0 (Normal Operating Pool Elevation).

7.2. Conduit. The conduit consists of a monolithic reinforced concrete pipe 72 inches in diameter and 408-feet long. Experience has shown that piping due to seepage is more likely to occur along the conduit than in any other location in or under the embankment. Therefore, in order to eliminate the possibility of piping, five seepage diaphragms were attached to the conduit. They are located near the axis of the dam with spacing between diaphragms of approximately 40 feet.

7.3. Stilling Basin and Outlet Channel. The stilling basin is a Saint Anthony Falls parabolic drop inlet type structure constructed of reinforced concrete. An outlet channel extends downstream from the stilling basin approximately 1,200 feet to the original creek channel. The first 80 feet of the channel downstream of the stilling basin is protected with riprap. The first 70 feet having 15 inches of riprap placed on 6 inches of bedding and the remaining 10 feet having 30 inches of riprap placed on 6 inches of bedding. The remainder of the channel is protected by a grass cover. Excavation of the channel was approximately 91,000 cubic yards.

8. INSTRUMENTATION AND RESPONSE.

8.1. General. Instrumentation for Branched Oak Dam and Reservoir consists of 28 pore pressure piezometers, 32 open tube type (downstream) piezometers, 4 foundation settlement gauges, 7 crest movement markers, 8 vertical movement inserts, and a reservoir stage recorder. Details of the instrumentation are given in the following sections.

8.2. Pore Pressure Piezometers. Twenty-eight pore pressure piezometers were installed at Branched Oak Dam in cross sections A, B, C, and D through the embankment as shown on Plate C1. The purpose of these piezometers is to monitor pore pressure response, migration, and dissipation during and after embankment construction. Twenty-four of these piezometers reach into the alluvium foundation. Four piezometers, one in each cross section, were installed near the embankment centerline with their tips set in fill near the base of the embankment. These four have always been dry with the exception of some seepage water draining down along the outside of the pipes from the manholes to the piezometers. This condition was eliminated when drains were installed in all four of the crest manholes in 1977. Of the original 28 piezometers 21 are currently operable and their water levels are read approximately every three months. The other seven piezometers were installed on the upstream slope of the dam below the normal pool level and have been under water since early 1969. Plots of all the piezometer readings

are shown on Plates C2 through C5. The readings indicate generally good response and in the expected range for these piezometers.

8.3. Open Tube Type Piezometers. There are 32 open tube type piezometers scattered throughout the downstream area of the dam. Plots of the water level readings, depths and locations of the piezometers are shown on Plates C6 through C10. Pressure tests of the piezometers in 1977 indicate that all the piezometers are functional and respond well. Readings indicate that the water levels are within the expected range for these piezometers.

8.4. Foundation Settlement Gauges. There are four foundation settlement gauges located along the centerline of the dam on piezometer lines A, B, C, and D as shown on Plate C11. The maximum settlement has been at gauge C-10U and is about 3.85 feet with approximately 3.4 feet of the settlement occurring during construction. All points appear to have a similar rate of settlement, and recent readings indicate that the rate of movement has leveled off.

8.5. Crest Movement Markers. Seven crest movement markers were placed at 600-foot intervals along the downstream edge of the crest as shown on Plate C12.

Because of the erratic plots of transverse movement shown on Plate C12, the accuracy of the line of sight method of surveys normally used was questionable, and therefore, was replaced by a coordinate method of surveys. Initial surveys in 1977 and surveys in 1980, using the coordinate method, indicate slight downstream movement as can be seen on Plate C13.

The maximum settlement occurs at point MI-2 which is over the valley alluvium near the right abutment, and is approximately 0.69 feet. The maximum differential settlement between points occurs between MI-1 and MI-2 and is approximately 0.73 feet. Overall, the movement plots of these points, given on Plate C12, indicate a very uniform settlement along the embankment except at point MI-2.

8.6. Intake Structure Movement. Four movement insert markers are located in the top of the intake structure as shown on Plate C14. Vertical movement surveys have been taken six times since the original readings were taken in January 1968. Plots of these surveys, shown on Plate C14, indicate a small and uniform settlement of the structure, having less than 0.10 feet total settlement. This stability is credited to its firm foundation of stiff to very stiff sandy and lean clay glacial drift.

8.7. Conduit Movement. Surveys of conduit movement are shown on Plates C15 and C16. With the exception of initial settlement during construction, little conduit movement has taken place. Surveys since March 1967 have shown less than 1 inch of differential movement and have shown no overall trend for the conduit to move either up or down. This stability is credited to the firmer foundation of Nebraskan Drift material under the conduit as opposed to the alluvial clay under the embankment in the valley. A plot of the change in length and a history plot of four vertical movement points along the conduit are shown on Plate C16.

8.8 Reservoir Stage Recorder. The reservoir stage recorder is housed in a 5-foot 4-inch, by 5-foot 4-inch, by 8-foot high concrete block structure located at the crest of the embankment near the outlet works. The instrument records reservoir levels in digital format on paper tape at 15-minute intervals. It is a bubbler type installation whereby the stage is determined by the hydrostatic pressure required to force nitrogen gas out of a submerged orifice. An auxiliary staff gauge with the same datum as the recorder is located near the intake of the outlet structure and extends from elevation 1271.0 feet m.s.l. to elevation 1287.0 feet m.s.l. The gauges are operated and maintained by Corps of Engineers personnel.

9. CONSTRUCTION MODIFICATIONS.

9.1. General. Six contract modifications occurred during the construction of this project. The changes were determined necessary and in the best

interest of the Government. Details of the modifications are given in the following section.

9.2. Contract Modifications.

(Mod. #1) October 1966. Modification No. 1 was a change in the specifications of the contract. Change was necessary to revise construction contract commitments to conform to real estate acquisition commitments. The contract price and time remained unchanged.

(Mod. #2) August 1967. Due to flooding in June 1967, debris consisting of logs and brush were deposited in the reservoir below the elevation of the permanent pool. The Contractor had previously completed the clearing and grubbing required by the contract, and did not by any act or failure to act contribute to the deposit of the debris. Therefore, since the debris was unacceptable in the permanent reservoir, a contract modification was made to allow for payment for removal of the debris. This resulted in an increase of \$800 in the contract price. The contract time remained unchanged.

(Mod. #3) September 1967. Due to abnormally bad weather between May and June, it was determined necessary to modify the contract time for performance of all work included in Items 3 and 4 of the Completion Schedule 22 calendar days. Items 3 and 4 consisted of the following: Item 3, complete outlet works and complete right and left abutment embankment; Item 4, complete all remaining work, except seeding. The contract price and completion time for all other work remained unchanged.

(Mod. #4) December 1967. This modification extended the completion date of Item 5 (Seeding) in the Completion Schedule 10 calendar days. The extension was necessary due to Mod. #3 which extended the time for performance of Items 3 and 4. (See Mod. #3). Since Item 4 was prerequisite to Item 5, the time extension was deemed necessary. The contract price remained unchanged.

(Mod. #5) July 1968. This modification gave the contractor an additional 45 calendar days to complete Item 1 (Complete Right and Left Abutment Embankment) of the contract. Misinterpretation of the Plans and Specifications caused an increased haul distance and delayed the completion of the embankment, thus requiring the additional time.

(Mod. #6.) July 1968. This modification provided for reimbursement to the contractor for loss of indirect costs as a result of underrun in quantity of contract Items 10, "Spalls," and 12, "Riprap-Type B." Contract price was increased by the lump-sum amount of \$2,841.56. The time for performance was unchanged.

10. OPERATIONAL HISTORY AND PERFORMANCE.

10.1. General. The Secretary of the Army granted a license to the State of Nebraskan and Parks Commission to use and occupy the land and water areas of the Branched Oak Dam and Reservoir for Public Park and Recreational purposes. For consideration of the privileges granted, the State was required to maintain the project in a manner acceptable to the District Engineer. In general, this requires routine maintenance. Any major repairs, either to the embankment, outlet works, or spillway, are accomplished by the Corps of Engineers.

10.2. Inspections. In-depth inspections of Branched Oak Dam and Reservoir are conducted in accordance with ER 1110-2-100, "Periodic Inspections and Continuing Evaluation of Completed Civil Works Projects." The inspections are reported in Periodic Inspection Reports Nos. 1 through 6, dated July 1968, September 1969, November 1970, July 1972, October 1974, and October 1979, respectively. The next periodic inspection of Branched Oak Dam is scheduled for 1984. These periodic inspections are made jointly by representatives of the Operations and Engineering Divisions of the Omaha District Corps of Engineers and by representatives of the Missouri River Division Office. The reports include the evaluation of the embankment, structural performance, and instrumentation observations.

In addition to the periodic inspections, annual inspections are made by the Operations Division of the Omaha Corps of Engineers, and monthly inspections have been performed by Fort Crook Area Forces since 1980. These reports include a comprehensive inspection of all features of the dam.

10.3. Reservoir Levels. Reservoir water surface elevation readings have been recorded daily since the ponding of reservoir water began. Of these readings, one middle of the month observation from each month has been plotted for record and is shown on Plate C6. These daily water surface elevation readings are taken either from the intake structure mounted staff gauge or from the water stage recorder located in the gauge house near the crest of the dam. The highest pool elevation reading ever recorded at this dam was 1286.6 (2.6 feet above normal operating pool) which occurred in October 1973.

10.4. Significant Operational Events.

10.4.1. Crest Road. In 1970, the upstream side of the crest was extended 12 feet by the State of Nebraska for the purpose of building a two-lane paved road across the crest of the dam. All costs and necessary work for completion of the project was the responsibility of the State of Nebraska with approval of the plans, specifications, etc., by the Corps of Engineers. A sectional view of the road is shown on Plate A17, and Plates B13 and B14 show views of the completed road.

10.4.2. Seepage. Branched Oak Dam and Reservoir has a history of seepage along the downstream toe of the embankment. The main areas of concern have been, (1) at the base of the right abutment approximately between sta. 10+00 and sta. 15+00, (2) near the center of the flood plain valley, (3) along the left cut slope downstream of the stilling basin, and (4) from the internal embankment sand drain outlet at sta. 41+00 located back and upstream of the stilling basin structure. Methods used to alleviate the problem in these areas are discussed in the following sections.

10.4.2.1. Relief Well. In 1975, a 6-inch diameter relief well was installed in the downstream embankment toe near the old creek channel at sta. 28+00. The well was used in an attempt to lower the ground water level in that area. It was thought that if it would relieve the hydrostatic pressure in the deeper sand stratum, that the drainage of overlying alluvium would improve, thus lowering the ground water level and minimizing local ponding. Recent inspections indicate that the relief well has been functioning as expected and the ground water level has subsided. Periodic flow measurements of the relief well are shown on Plate C6, and the discharge end of the well is shown on Plate B11. Details of design and a cost summary of the relief well and perforated pipe (discussed in next paragraph) are presented in Design Memorandum No. MSC-23.

Besides the relief well, a 6-inch perforated drain pipe was placed in the same trench parallel to and at the same elevation as the relief well out-flow pipe. This drain has flowed steady at approximately 5 gpm and indicates that shallow drains such as this are effective in lowering local high ground-water problems. However, since the relief well is also in the area the actual effect of the shallow drain cannot be determined.

10.4.2.2. Seepage Drains. In 1977-1978, two seepage drains were installed in the vicinity of the stilling basin. A 2-inch pipe was installed into the embankment drain at the toe of the embankment approximately along a line with the centerline of the stilling basin to provide a controlled outlet for any seepage through the drain. The second drain is a 4-inch perforated pipe installed along the left side of the stilling basin cut slope at elevation 1252.0. The purpose of the drain is to provide a controlled outlet for seepage that drains from the left abutment area. According to the 1979 Periodic Inspection Report, these drains were functioning well and keeping the area dry. See Plate C6 for a plot of the flow readings, Plate A39 for drain details, and Plates B12 and B13 for views of the drains.

The drains were installed as part of the Salt Creek - Outlet Works Rehabilitation (Phase I), which included channel cleanout and conduit grouting performed at various other Salt Creek Dams. The work was performed by Technical Inspections Corp. of Lincoln, Nebraska, under contract No. DACW45-77-B-0086. Total contract cost was \$114,708.50 with approximately \$18,800 allotted for the seepage drains at Branched Oak.

10.4.3. Service Road. In 1976, a crushed rock surfaced service road was constructed along the upstream embankment slope. It was constructed by Theisen Bros. Inc., of Norfolk, Nebraska under Contract No. DACW45-76-B-0100 at a cost of \$33,280. The road was built by cutting into the slope along the top side of the upstream slope riprap protection. It was constructed primarily for inspection and more efficient maintenance of the upstream slope. Before the road was constructed, a barge or a temporary construction road cut into the upstream slope was necessary each time riprap repair was required. Details of the design of the road are presented in Design Memorandum No. MSC-25. Plan and sections of the service road are shown on Plate A40. Plates B3, B10, and B11 show views of the service road during and after construction.

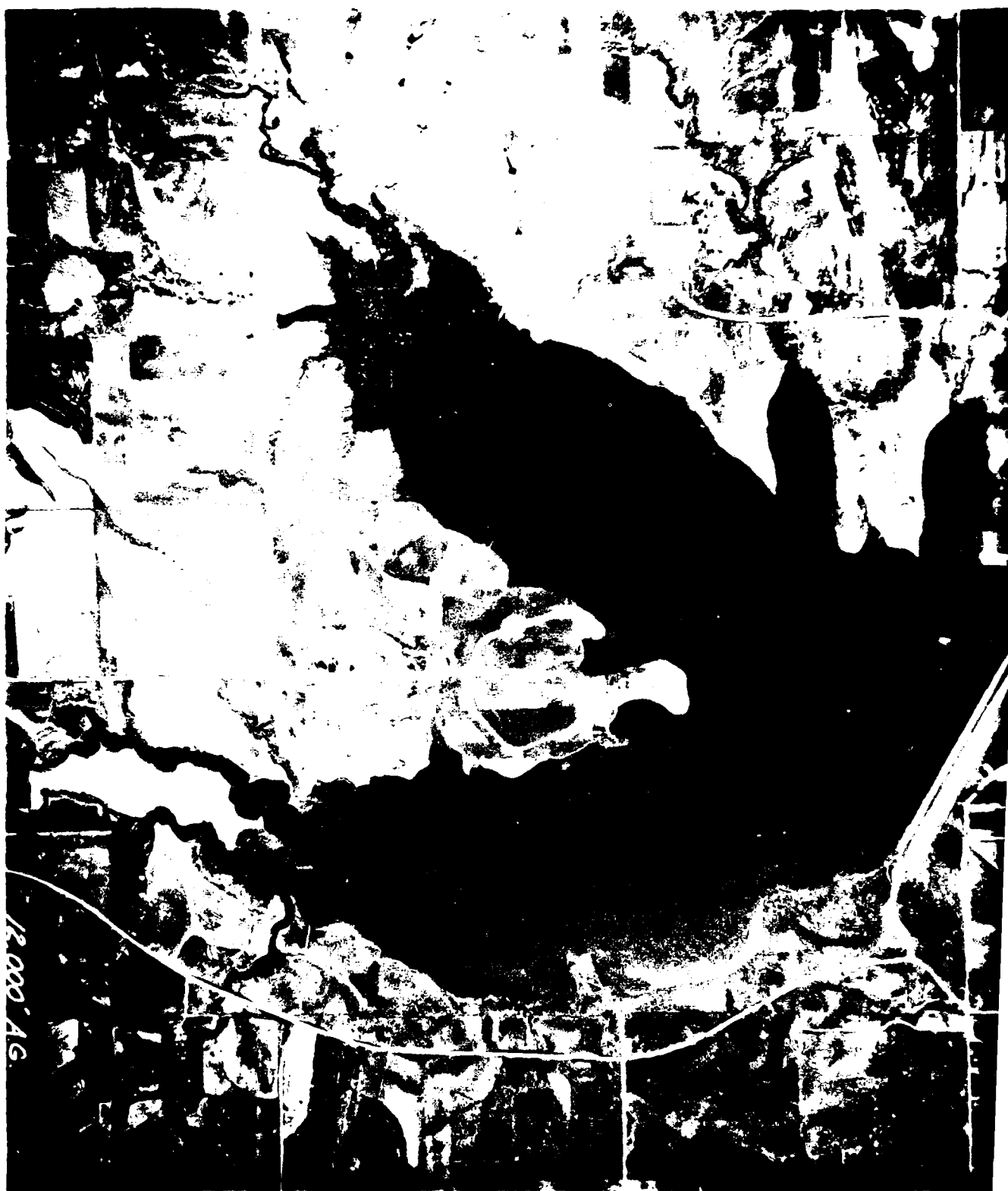
10.4.4. Water Rights Gate. In October 1981, a 10-inch diameter gate was constructed into the intake structure as shown on Plate A37. The gate is used to release water for downstream needs. Its small size enables it to be used more efficiently than the structure's 4-foot by 6-foot gate which was originally used.

The gate was constructed by contract (No. DACW 45-81-C-0229) at a cost of approximately \$7,000. The contractor was Pro Dive Incorporated of Ottawa, Illinois.

10.5. Performance. The Branched Oak Dam and appurtenant structures are in good condition. Since 1967, when the project was completed, periodic annual, and monthly inspections and evaluations of the instrumentation data

has revealed no significant problems concerning the safety of the dam. The maximum reservoir level attained at Branched Oak Dam since its completion occurred in October 1973 and was 1286.6 feet m.s.l. This was 2.6 feet above the normal operating pool and 24.4 feet below the spillway crest. The project is well maintained, and because of its relative close proximity to the Omaha District Offices, it can readily be inspected if potential problems develop. Maintenance problems which do develop are generally rectified before they turn into major problems which may subsequently affect the integrity of the dam.

APPENDIX A
DRAWINGS



18,000' Ag

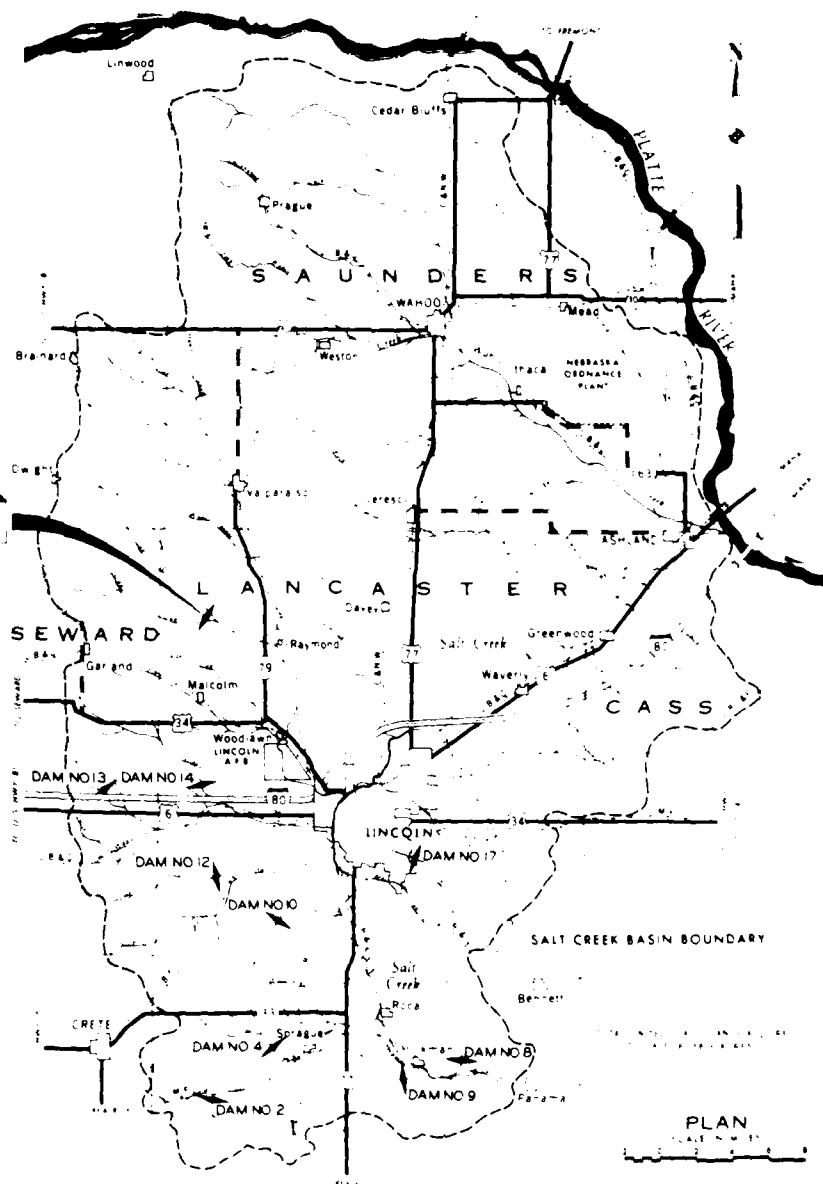
10-31-77

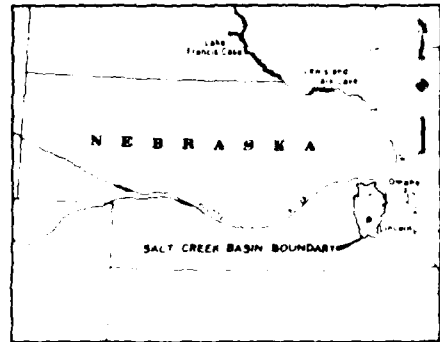
12

BRANCHED OAK LAKE

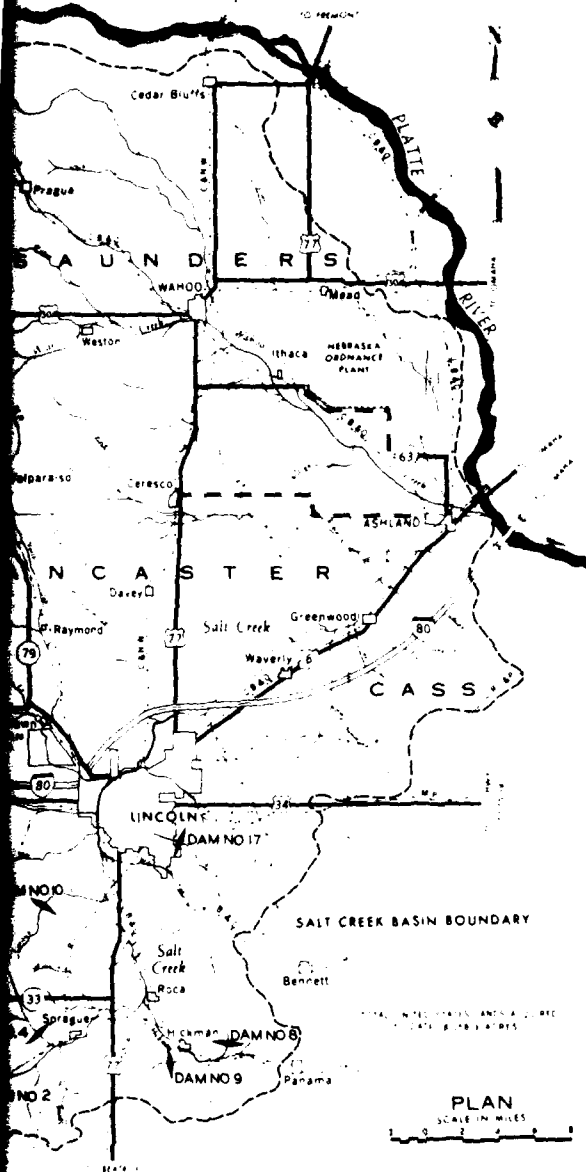
SALT CREEK, NEBRASKA
BRANCHED OAK DAM
SITE 18
AERIAL PHOTOGRAPH

BRANCHED OAK DAM
SITE NO 18





LOCATION MAP



PLAN

SCALE IN MILES



THIS PLAN ACCOMPANIES CONTRACT NO. 04CA45
MODIFICATION NO.

DATE		DESCRIPTION	
REV. 1		REV. 2	
U. S. ARMY ENGINEER DISTRICT OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
BRANCHED OAK DAM AND LAKE SITE NC 8			
PROJECT LOCATION MAP			
DESIGNED BY	SECTION	APPROVED	DATE
DRAWN BY			
CHECKED BY			
APPROVED BY			
DATE	SCALE	ENGINEER	DATE

SS - THINK VALUE ENGINEERING - SS

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983)

PLATE A1

2

[illegible]

LOCATION OF POINTS				
POINT NO.	STATION	COORDINATES		BEARING
		NORTH	EAST	
1	Emb. 0+00	484,760.00	2,729,500.00	
2	Emb. P.I. 6+61.57	485,388.87	2,729,702.32	N17°48'27"E
3	Emb. P.I. 46+41.18	488,957.37	2,731,466.24	N26°18'29"E
4	Emb. 51+79.56	488,500.00	2,731,500.00	N 3°33'42"E
5	Emb. 41+20	488,490.43	2,731,235.25	
6	OW P.I. 600' Rt.	488,224.51	2,731,773.10	S63°41'31"E
7	SW Sta. 0+00	492,135.00	2,731,000	
8	SW P.I.	492,870.00	2,732,150	N57°24'58"E
9	SW Sta. 26+87.08	492,800	2,733,700	S67°24'51"E



CURVE "A" EMB.

Δ 8° 30' 02" R
D 4' 00'
T 106.45'
L 212.51'
R 1432.395'
PC 5+55.12
PT 7+67.63

CURVE "B" EMB.

Δ 22° 44' 47" L
D 6' 00'
T 192.08'
L 379.11'
R 954.93'
PC 44+49.10
PT 48+28.21

CURVE "C" OUTLET WORKS

Δ 62° 00" R
D 20' 00'
T 172.13'
L 310.00'
R 286.47'
PC 427.87 Rt.
PT 737.87 Rt. on O.R.L.

CURVE "D" SPILLWAY

Δ 35° 10' 11"
D 4' 00'
T 453.97'
L 879.24'
R 1432.41'
PC 9+10.85
PT 17+90.00

LEGEND:

- 250 — EXISTING GROUND CONTOURS
- 280 — NEW GROUND CONTOURS
- X — EXISTING FENCE
- VRX — EXISTING FENCE TO BE REMOVED
- (Symbol) — BRUSH AND TREES
- (Symbol) — EXISTING UTILITY LINES
- (Symbol) — EXISTING BUILDINGS
- (Symbol) — U.S. GOV'T. BOUNDARY
- (Symbol) — EARTH WORK THIS CONTRACT
- (Symbol) — STONE PROTECTION THIS CONTRACT
- (Symbol) — GRAVEL SLOPE PROTECTION THIS CONTRACT

GENERAL NOTE:

1. For applicable General Notes, see PLATE A3.

THIS DRAWING HAS BEEN REDUCED TO
THREE EIGHTS THE ORIGINAL SCALE

LOCATION OF POINTS

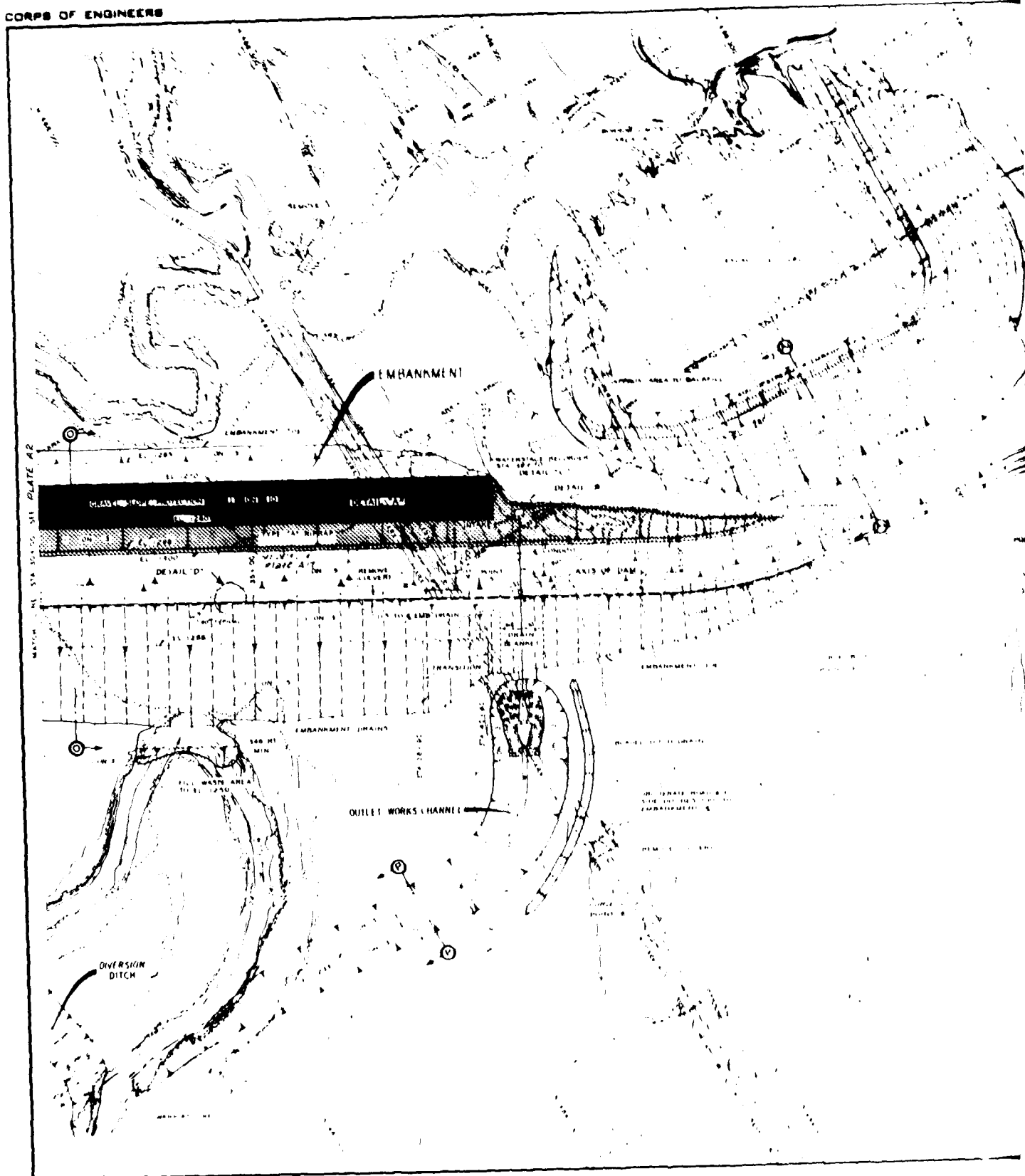
POINT NO.	STATION	COORDINATES		BEARING
		NORTH	EAST	
1	Emb. 0+00	484,760.00	2,729,500.00	N17° 48' 27" E
2	Emb. P.I. 6+61.57	485,389.87	2,729,702.32	N26° 18' 29" E
3	Emb. P.I. 46+41.18	488,957.37	2,731,466.24	N 3° 33' 42" E
4	Emb. 51+79.56	489,500.00	2,731,500.00	
5	Emb. 41+20	488,490.43	2,731,235.25	S63° 41' 31" E
6	On P.I. 600' Rt.	488,224.51	2,731,773.10	
7	SW Sta. 0+00	492,135.00	2,731,000	N57° 24' 58" E
8	SW P.I.	492,870.00	2,732,150	S67° 24' 51" E
9	SW Sta. 28+87.08	492,800	2,733,700	

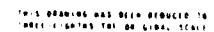
SCALE 1 INCH = 100 FEET
100 0 100



THIS PLAN ACCOMPANIES CONTRACT NO. 100P100000000
MODIFICATION NO.

U. S. ARMY ENGINEER DISTRICT, OMAHA GROUP OF ENGINEERS OMAHA, NEBRASKA	
BALT CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM AND LAKE SITE NO. 18	
EXCAVATION AND EMBANKMENT PLAN SHEET 1	
DESIGNED BY: C.E.C.	DATE: JULY 1968
CHECKED BY: C.W.O.	
APPROVED BY: L.S.S.	
DRAWN BY: [Signature]	
SCALE: AS SHOWN	



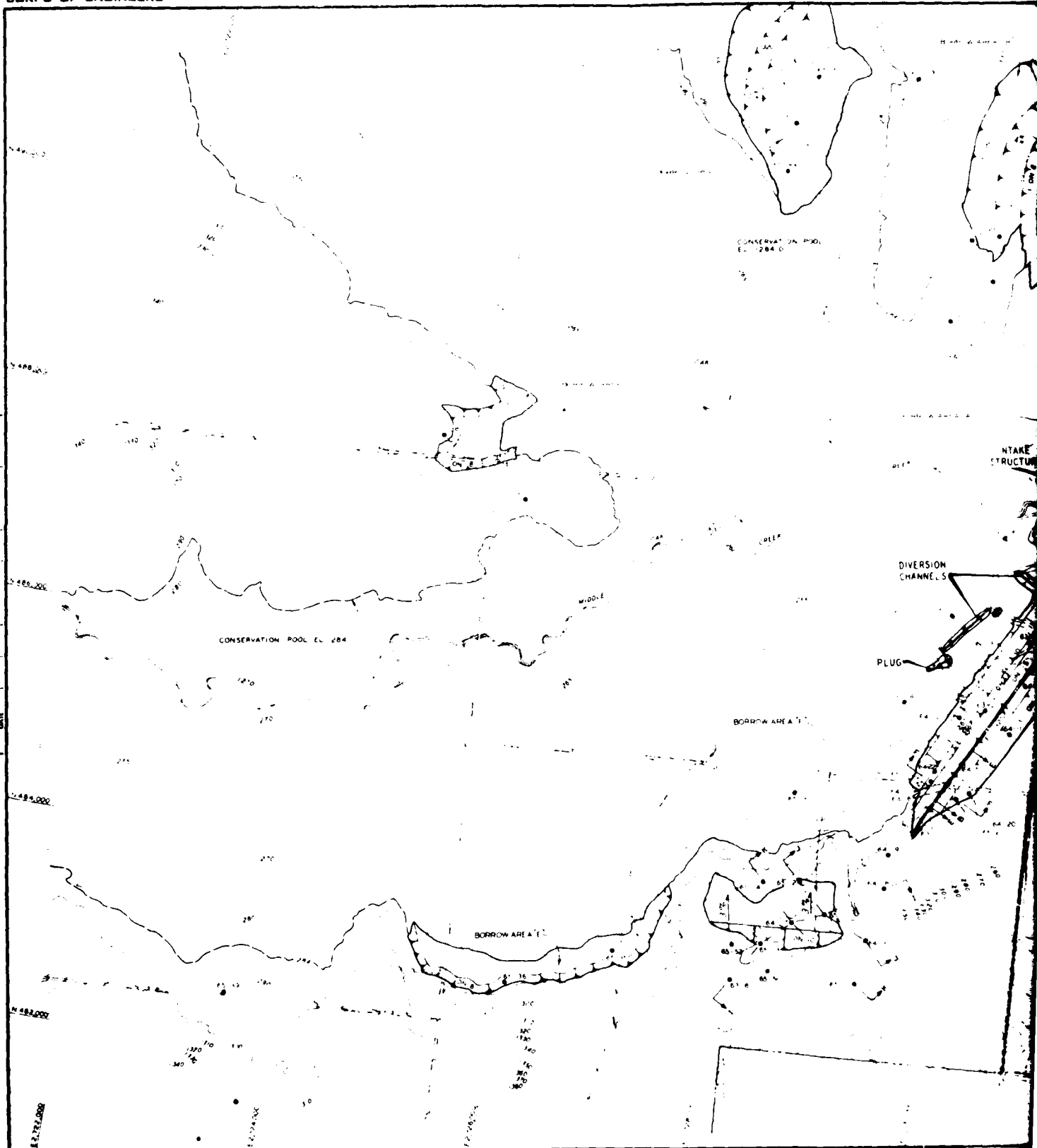


1. The exact alignment grade, width and side slopes of the diversion ditches and plugs will be selected by the contractor, subject to approval. (The ditches are optional if other means are used to provide drainage in and upstream of the embankment area).
2. Waste material shall be placed in the channel fills at the downstream toe of the embankment. The material shall be placed in 21 lifts and traffic compacted as directed. The material may be placed alongside of the channel until after closure.
3. Natural terraces shall be maintained against the embankment so as to prevent drainage along the embankment toe.
4. The alignment and grade of all bladed drain ditches shall be established in the field.
5. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
6. For sections, details and profiles, see *PLATES A5 and A17*.
7. For control points, see *PLATE A2*.
8. For legend, see *PLATE A2*.
9. Borrow area grading shall be accomplished to the approximate new contours shown.

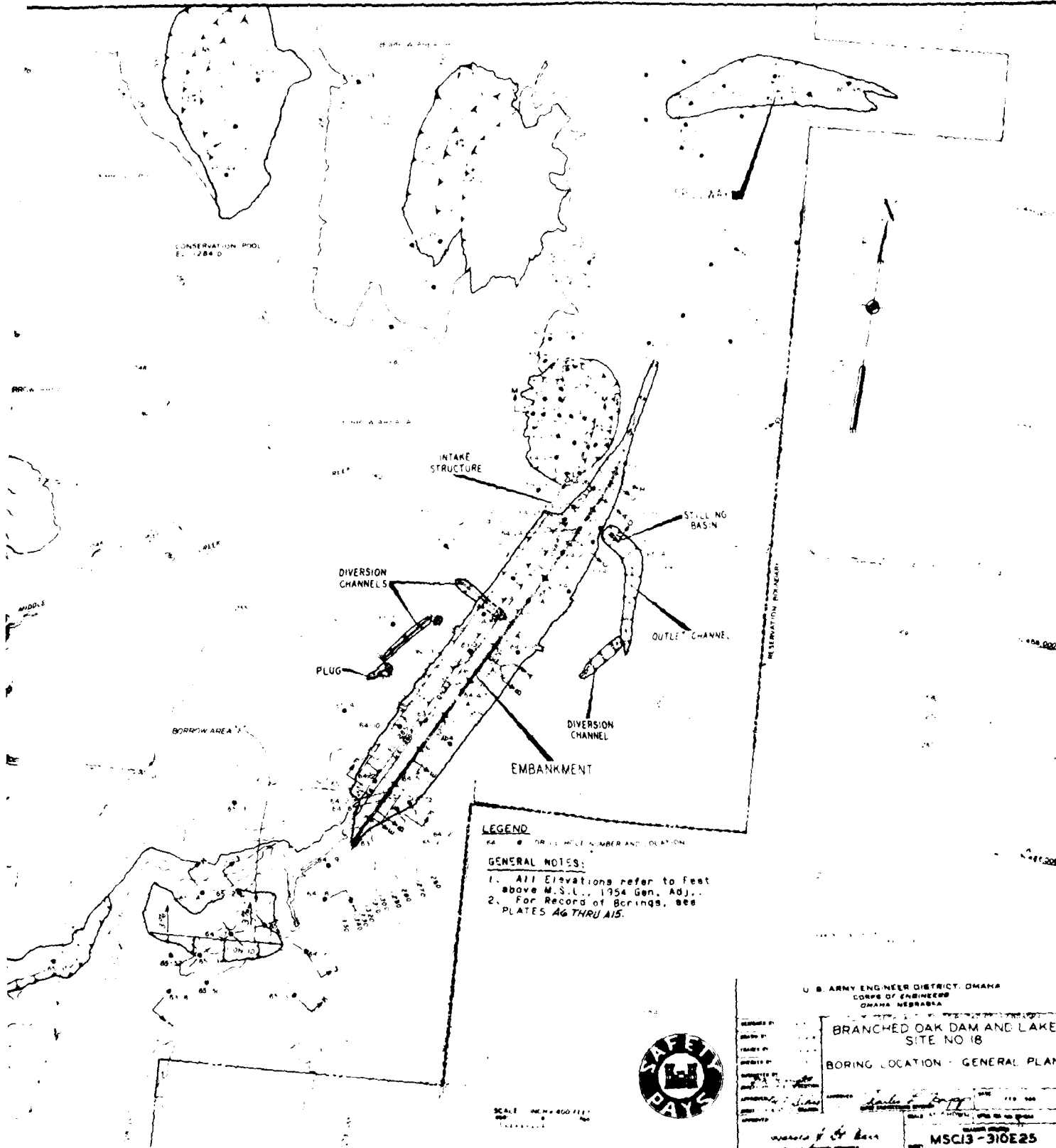
DATE	DESCRIPTION	AMOUNT	APPROVED
	DEPOSITED		
<p align="center">U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA</p>			
RECEIVED BY: V. G. CHECK NO.: 100 DATE OF: 7/1/58 RECEIVED BY: L. S. <i>W. H. Smith</i> W. H. Smith, Inc. <i>W. H. Smith</i> APPROVED	<p align="center">SALT CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM AND LAKE SITE NO. 18 EXCAVATION AND EMBANKMENT PLAN SHEET 2</p> <p>DATE: JULY 1 1958 MADE AS ORDER: <i>John F. Hopp</i> BY: JOHN F. HOPP DESIGNED BY: JOHN F. HOPP</p>		

MODIFICATION NO.	SEC. 505 SPECIAL PERMIT NO.	DATE
EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983)		PLATF A3

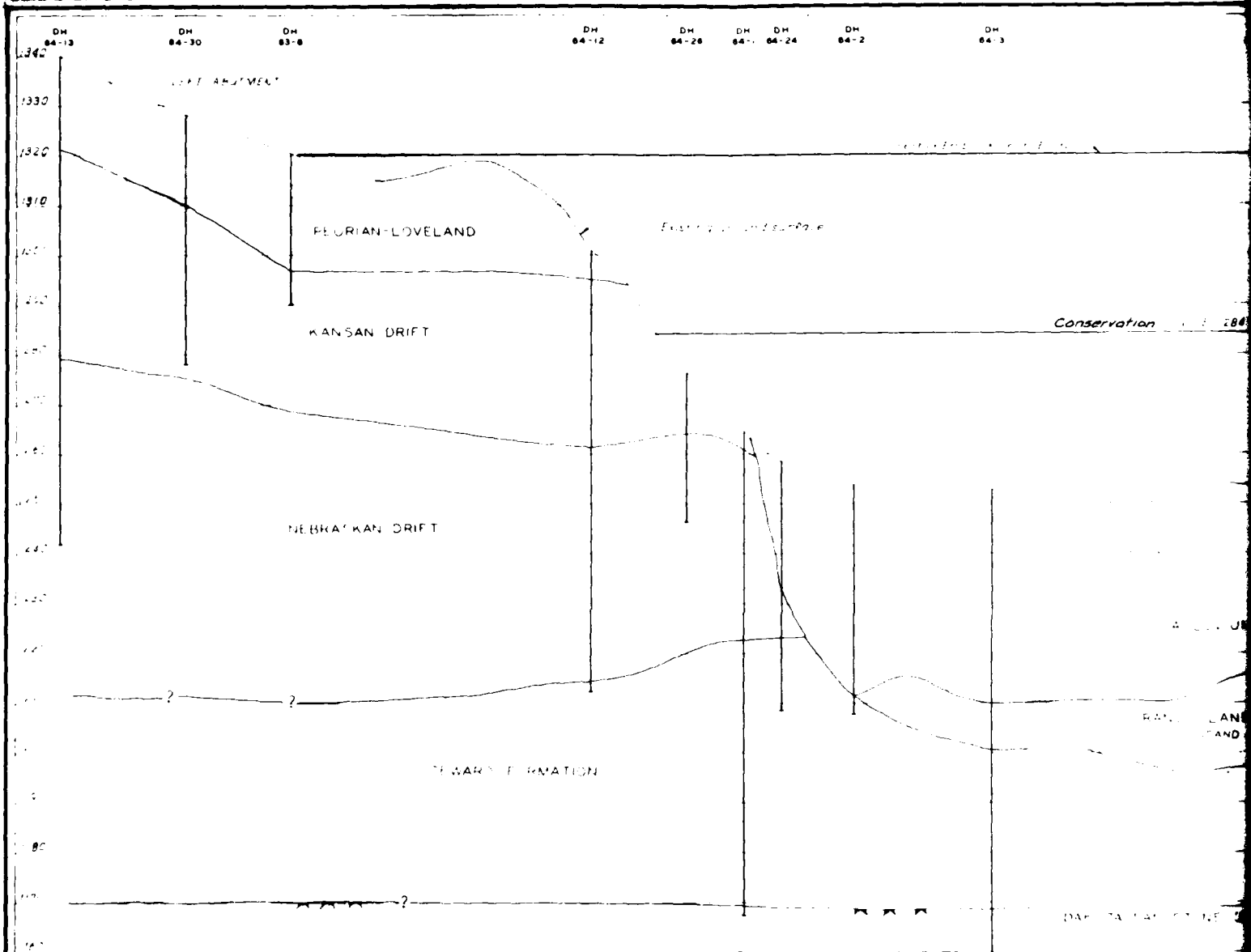
AMENDMENT	DATE	MODIFICATION
		PAGE



EM



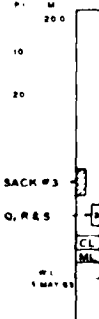
CORPS OF ENGINEERS



AGE	FORMATION	DESCRIPTIVE NOTES
QUATERNARY	PEURIAN (LOESS) FORMATION AND LOWLAND (LOESS CLAY) FORMATION UNDIFFERENTIATED.	BOLIAN (WIND-BLOWN) DEPOSITS, ALTHOUGH THE LOWER MORE CLAYEY LOWLAND IS PARTIALLY AQUICLUS.
	KANSAN GLACIAL DRIFT	ALL SEDIMENTS DEPOSITED DURING KANSAN GLACIAL STAGE, PRIMARILY A PEBBLY-CLAY (TILL) AT THIS SITE.
	GRAND ISLAND FORMATION	SANDS AND GRAVELS DEPOSITED IN PRE-KANSAN VALLEYS BY EASTWARD FLOWING STREAMS FROM WEST OF THE TILL BORDER DURING KANSAN GLACIAL STAGE.
	AFTONIAN FORMATION	AN INTERGLACIAL DEPOSIT OF SILT, SAND AND CLAY DERIVED FROM THE OLDER NEBRASKAN DRIFT BY EROSION.
	NEBRASKAN GLACIAL DRIFT	TILL, PRIMARILY A PEBBLY CLAY DEPOSITED ON THE TERTIARY PLAINS DURING THE NEBRASKAN GLACIAL STAGE. SILTS AND SANDS, GLACIALLY MIXED AND PARTIALLY GRADED. SOURCES PUSHED AHEAD OF THE ADVANCING GLACIER AND DEPOSITED IN THE TERTIARY LOWLANDS.
TERTIARY	SEWARD FORMATION	SILTS AND CLAYS, USUALLY CALCAREOUS, DEPOSITED PRIMARILY IN THE LOWLANDS OF THE NORTH CRETACEOUS TOPOGRAPHY.
CRETACEOUS	DAKOTA FORMATION	PRIMARILY SANDSTONES AND SHALES. ONLY SANDSTONE ENCOUNTERED AT THE SITE.

LEGEND

DH 63-7
13270
MAY 1963



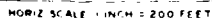
Drill Hole Number
Elevation at Top of Ground
Date of Boring
(M) Percent of moisture at time of drilling as determined by Laboratory Test.
(P.I.) Plasticity Index
(L.L.) Liquid Limit
Atterberg Limits based on visual comparison with similar sample actually tested.
(S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches
Location and identifying number of each sample taken.
Location and identifying number of undisturbed sample taken and the type of test performed.
Soil Classification based on Atterberg Limits, Mechanical Analysis and Visual Comparison.
Static water level and date recorded.
Inspector's field description of soil encountered.

CLASSIFICATION OF SOILS

- CB FINE AND SANDY FINE CLAY
- CL LOAM, SANDY, SILTY AND
- ML SILT, SANDY AND CLAYEY
- OL SILTY SAND AND SILTY CLAY
- CH CLAYEY SAND
- SH SAND OF GRAVELLY SAND
- SL SAND OF GRAVELLY SAND
- GS SILTY SANDY GRAVEL

GENERAL NOTES

- 1. All Elevations shown are U.S.L., 1929 General Adm.
- 2. Per location of Boring



D H 63 /
 13270
 MAY 1963

Drill Hole Number
Elevation at Top of Ground
Date of Boring
(N) Percent of moisture at time of drilling
as determined by Laboratory Test.

(M) Percent of moisture at time of drilling
as determined by Laboratory Test.

(P.I.) Plasticity Index

(L.L.) Liquid Limit

Atterberg Limits based on visual comparison
with similar sample actually tested.

3.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches

Location and identifying number of each sample taken.

Location and identifying number of undisturbed sample taken and the type of test performed.

Soil Classification based on Atterberg limits,
Mechanical Analysis and Visual Comparison.

Static water level and date recorded.

Inspector's field description of soil encountered.

CE	FAT AND SANDY FAT CLAY
CL	LEAN, SANDY, SILTY AND GRAVELLY CLAY
ML	SILT, SANDY AND CLAYEY SILT
SM	SILTY SAND & SILTY GRAVELLY SAND
SC	CLAYEY SAND
SP	SAND OR GRAVELLY SAND, POORLY GRAINED
SM	SAND OR GRAVELLY SAND, WELL GRAINED
GM	SILTY SANDY GRAVEL

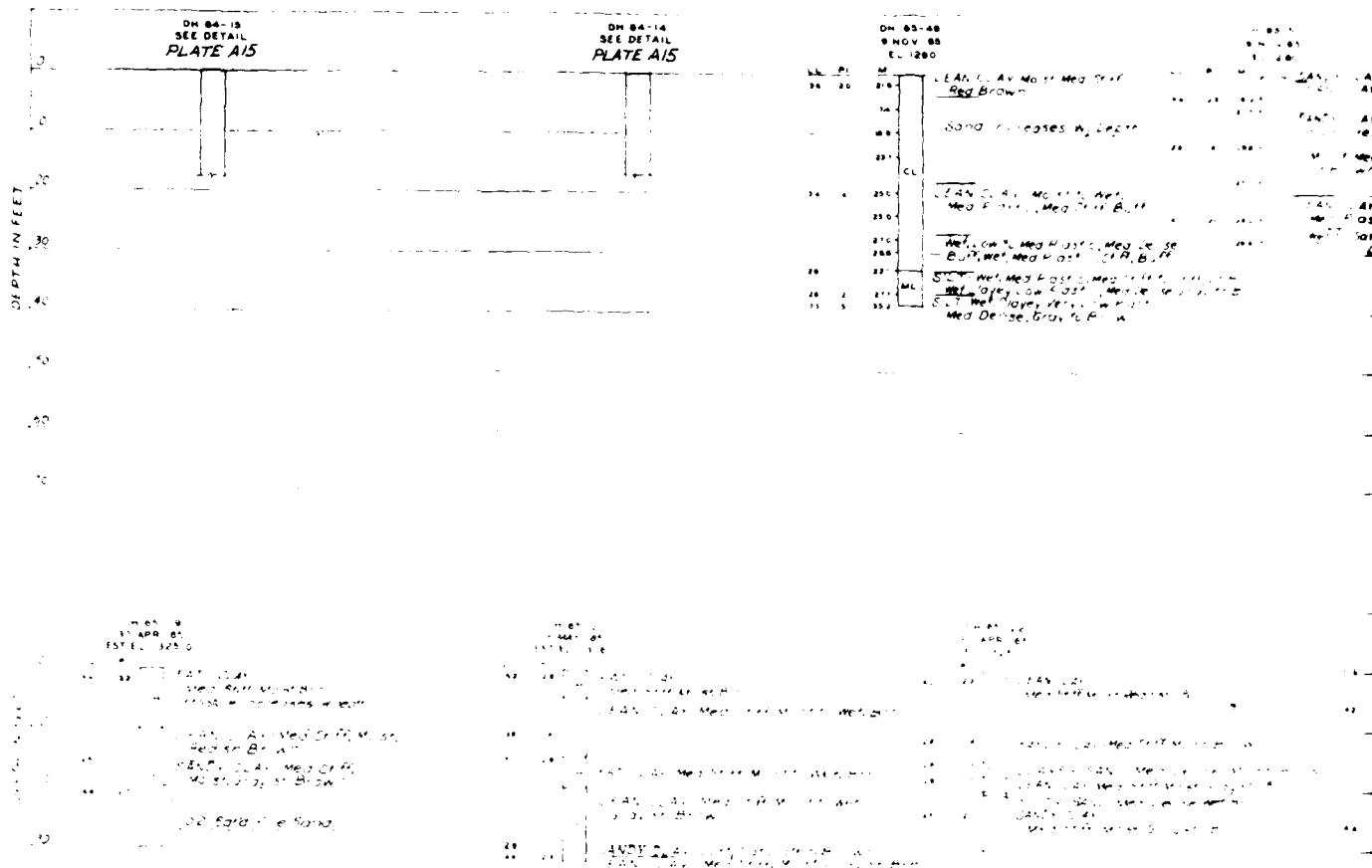
1. All Elevations shown refer to feet above U.S.L., 1929 General Adjustment.
2. For location of Springs, see plate A4.



THIS PLAN ACCOMPANIES CONTRACT NO.
 DA-38-066-4 MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROVED
	REVISION		
<p align="center">U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA</p>			
DESIGNED BY	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA		
SKETCH BY	BRANCHED OAK DAM & RESERVOIR		
TRACED BY	GENERAL SOIL & GEOLOGIC PROFILE		
CHECKED BY	ALONG EMBANKMENT CENTERLINE		
REVIEWED BY			
APPROVED	APPROVED	DATE	
APPROVED	APPROVED	DATE	

COPIES	AMENDMENT	MODIFICATION
	DATE	DATE
1		

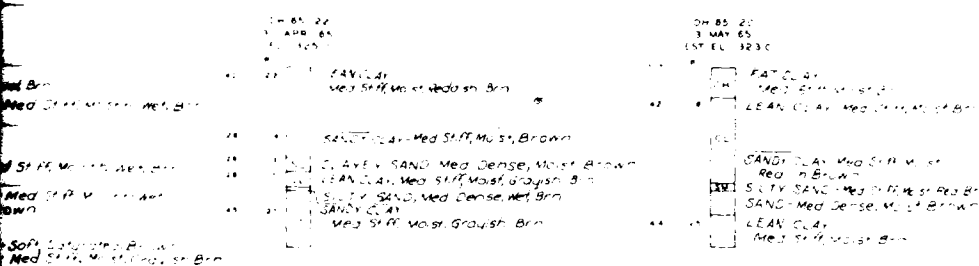
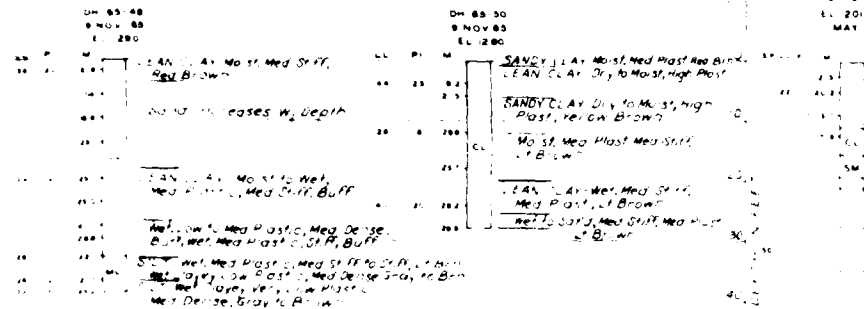


1. The data shown graphically and by symbol for each respective boring represents the actual geologic features observed and logged at the location given on the drawings. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of this region are anticipated and, if encountered, such variations will not be considered as differing "materially" within the purview of Article IV of the contract.
2. Descriptions of material, based on visual inspection in the field, are shown to the right of the graphic log.
3. Absence of water readings in the Graphic Log of any boring is not necessarily to be construed that ground water will not be encountered in excavation at that location.
4. Information on material has been condensed in the Graphic Logs. Additional information is shown on field logs which may be inspected at the Omaha District Office.
5. Undisturbed sampling was accomplished with a coring drill using a Shelby tube sampler. Disturbed samples were obtained with a percussion type drill using an open end drive barrel.

Brown	Bwn.	Med
Calcareous	Calc.	Occ
Carbonaceous	Carb.	Pit
Dark	Ok.	Sat
Gray	Grv.	Sec
Light	Lt.	Var
Material	Mat'l.	Wit

SW	SAND OR GRAVELLY SAND
SP	SAND OR GRAVELLY SAND
SM	SILTY SAND OR SILTY
SG	CLAYEY SAND OR CLAYEY
ML	SILTS, SANDY SILTS, OR CLAYEY SILTS
CL	LEAN CLAYS, SANDY CLAYS OR GRAVELLY CLAYS
CH	FAT CLAYS

Proposed excavation limits this contract (S.P.) Standard Penetration in blows per foot required to drive a 2" O.D. sampler by dropping a 140 lb. hammer 30 inches.



Brown	Bnn.	Medium	Med.
Calcareous	Calc.	Occasional	Occ.
Carbonaceous	Carb.	Plasticity	Plast.
Dark	Dk.	Saturated	Sat.
Gray	Gry.	Scattered	Scat.
Light	Lt.	Very	V
Material	Mat'l.	With	W

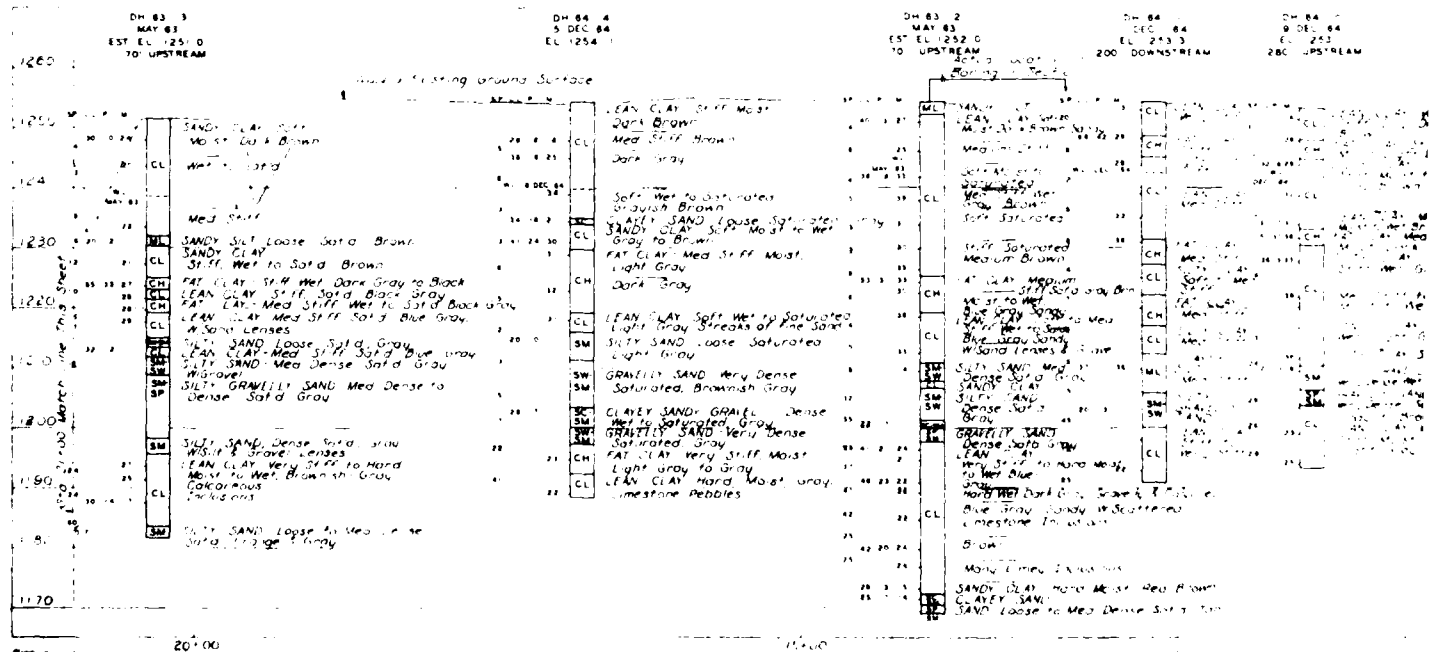
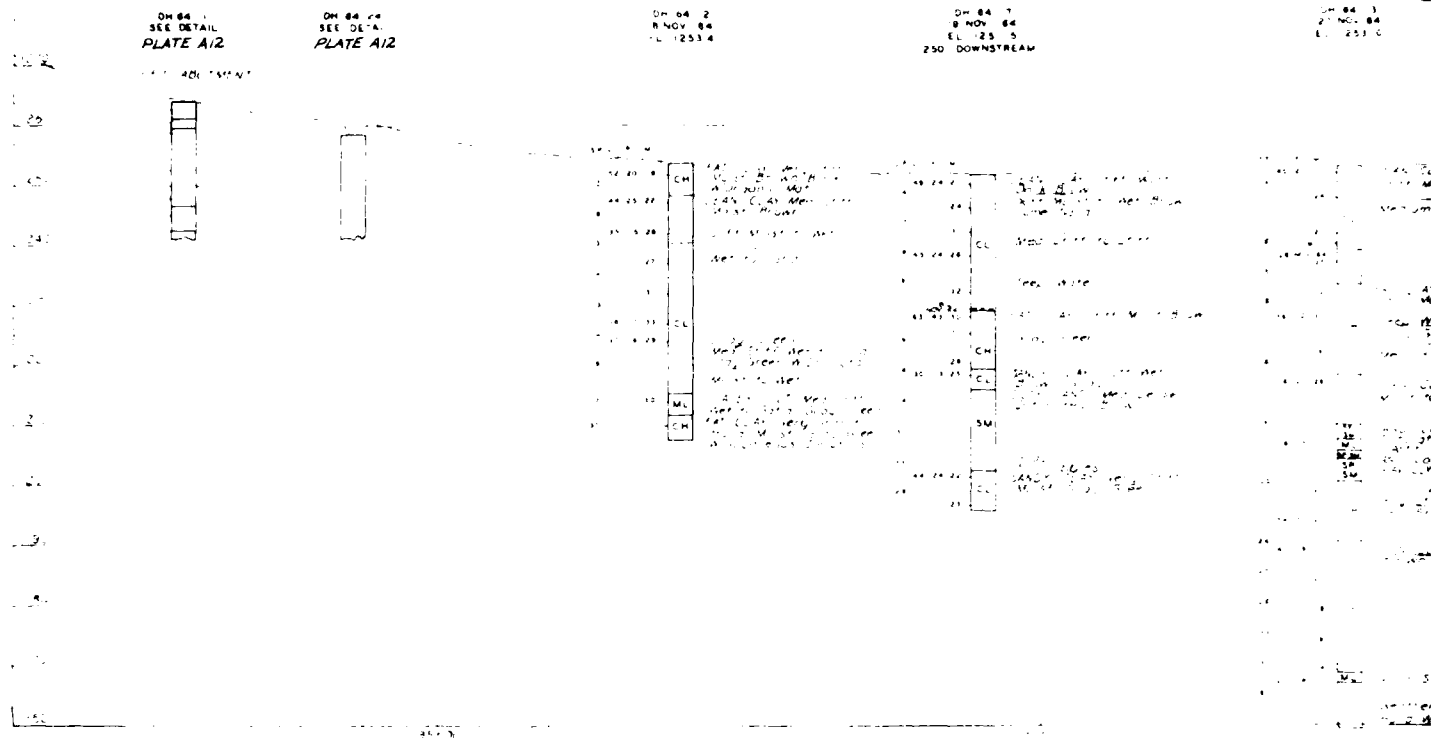
SW	SAND OR GRAVELLY SAND, WELL GRADED
SP	SAND OR GRAVELLY SAND, POORLY GRADED
SM	SILTY SAND OR SILTY GRAVELLY SAND
SC	CLAYEY SAND OR CLAYEY GRAVELLY SAND
ML	SILTS, SANDY SILTS, GRAVELLY SILTS OR CLAYEY SILTS
CL	LEAN CLAYS, SANDY CLAYS, SILTY CLAYS OR GRAVELLY CLAYS
CH	FAT CLAYS

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of Benings, see Plate A4.

Sampling was accomplished with
using a Shelby tube sampler.
Slies were obtained with a per-
drill using an open end drive

[illegible]

CORPS OF ENGINEERS

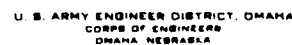


GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.

RIGHT VALLEY ALONG EMBANKMENT SECTION E-B

SCALE VERT. 1 INCH = 10 FEET
HORIZ. 1 INCH = 50 FEET



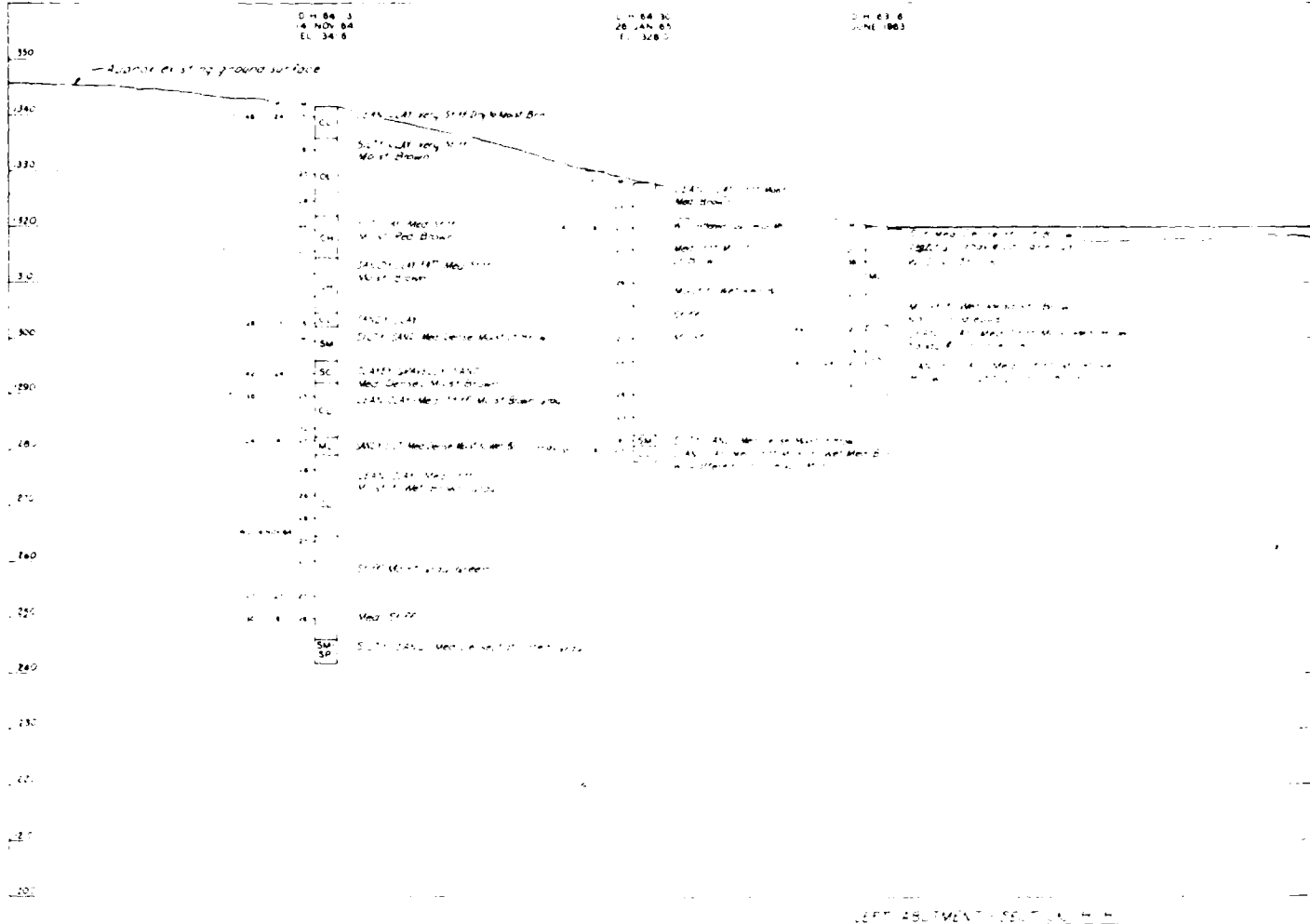
BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
EMBANKMENT AREA
SECTIONS A-A AND B-B

RIGHT VALLEY ALONG EMBANKMENT & SECTION B B

SCALE VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 50 FEET

DESIGNED BY	BRANCHED OAK DAM AND LAKE		
DRAWN BY	SITE NO 18		
TRACKED BY	RECORD OF BORINGS		
GRUNDED BY	EMBANKMENT AREA		
REMARKS BY	SECTIONS A-A AND B-B		
APPROVED BY	DATE	FILE NO	
<i>W. A. [Signature]</i>	<i>Charles P. [Signature]</i>		
DATE	FILE NO	DATE	FILE NO
<i>David L. [Signature]</i>			
PROJECT NO.		PROJECT NO.	
		MSC13-310E27	

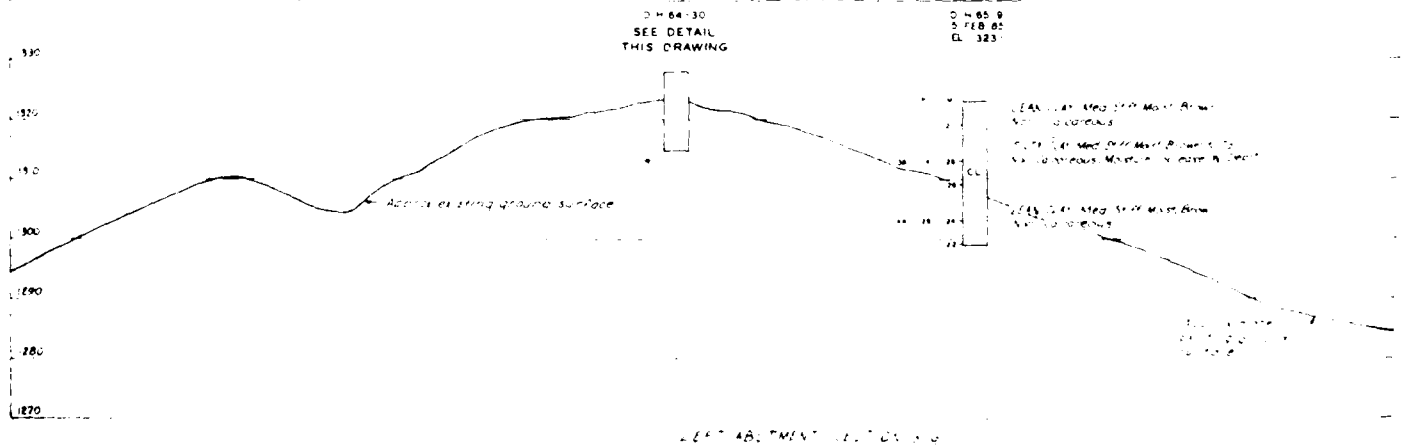
CORPS OF ENGINEERS



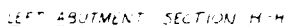
A 105 Micro-master Film or a Paper Reproducible Record
copy must be made before every Amendment and/or Modification.

Introduction

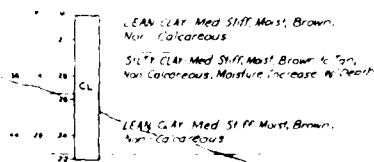
DATE

DATE _____
ACCOMPLISHED BY _____

1. 2. 3.



D 44 85-9
5 FEB 85
EL 13231



Approximate
test ground
surface

دینا، دینا، دینا

1. All elevations shown refer to feet above
mean low water, 1984 Adj.

... for Survey Legend, Classification of Soils
and Descriptive Notes, see ALE A6.

Location of Borings, see PLATE A4.

U S ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO. 8
RE. 1000' E. 1000' N.
1000' E. 1000' N.
1000' E. 1000' N.

MSC13-310E 28

4 FEB 65
1 10 2

1. 04
 2. 04
 3. 04

[illegible][illegible]

SCALE VERT INCH = 2 FEET
HORIZ INCH = 40 FEET

3- 85 2
 5 FEB 65
 F. 322

2- 85
2- 18 85
E. : 343

24	64	8
30	0E	64
1	33	3

A 105 Micro-master Film or a Paper Reproducible "Record by Mus" is Made Before Every Amendment and/or Modification

Copy
AMOUNT
DATE
MODIFICATION

OH 64-18
10 JAN 64
EL 13300

DM 65 11
EL 1343 1

DN 64 17
SEE DETAIL
THIS DRAWING

SECTION 1-1
SCALE VERT 1 INCH = 6 FEET
HORIZ 1 INCH = 50 FEET

DM 85 13
 3 FEB 65
 EL 1334 7

Section 10

Depth (ft)	Stratigraphic Unit	Description
0	CL	Medium Brown
10	CL	Light Gray
20	CL	Mostly to Wet
30	CL	Mostly to Wet
40	CL	Mostly to Wet
50	CL	Mostly to Wet
60	CL	Mostly to Wet
70	CL	Mostly to Wet
80	CL	Mostly to Wet
90	CL	Mostly to Wet
100	CL	Mostly to Wet
110	CL	Mostly to Wet
120	CL	Mostly to Wet
130	CL	Mostly to Wet
140	CL	Mostly to Wet
150	CL	Mostly to Wet
160	CL	Mostly to Wet
170	CL	Mostly to Wet
180	CL	Mostly to Wet
190	CL	Mostly to Wet
200	CL	Mostly to Wet
210	CL	Mostly to Wet
220	CL	Mostly to Wet
230	CL	Mostly to Wet
240	CL	Mostly to Wet
250	CL	Mostly to Wet
260	CL	Mostly to Wet
270	CL	Mostly to Wet
280	CL	Mostly to Wet
290	CL	Mostly to Wet
300	CL	Mostly to Wet
310	CL	Mostly to Wet
320	CL	Mostly to Wet
330	CL	Mostly to Wet
340	CL	Mostly to Wet
350	CL	Mostly to Wet
360	CL	Mostly to Wet
370	CL	Mostly to Wet
380	CL	Mostly to Wet
390	CL	Mostly to Wet
400	CL	Mostly to Wet
410	CL	Mostly to Wet
420	CL	Mostly to Wet
430	CL	Mostly to Wet
440	CL	Mostly to Wet
450	CL	Mostly to Wet
460	CL	Mostly to Wet
470	CL	Mostly to Wet
480	CL	Mostly to Wet
490	CL	Mostly to Wet
500	CL	Mostly to Wet
510	CL	Mostly to Wet
520	CL	Mostly to Wet
530	CL	Mostly to Wet
540	CL	Mostly to Wet
550	CL	Mostly to Wet
560	CL	Mostly to Wet
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580	CL	Mostly to Wet
590	CL	Mostly to Wet
600	CL	Mostly to Wet
610	CL	Mostly to Wet
620	CL	Mostly to Wet
630	CL	Mostly to Wet
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650	CL	Mostly to Wet
660	CL	Mostly to Wet
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730	CL	Mostly to Wet
740	CL	Mostly to Wet
750	CL	Mostly to Wet
760	CL	Mostly to Wet
770	CL	Mostly to Wet
780	CL	Mostly to Wet
790	CL	Mostly to Wet
800	CL	Mostly to Wet
810	CL	Mostly to Wet
820	CL	Mostly to Wet
830	CL	Mostly to Wet
840	CL	Mostly to Wet
850	CL	Mostly to Wet
860	CL	Mostly to Wet
870	CL	Mostly to Wet
880	CL	Mostly to Wet
890	CL	Mostly to Wet
900	CL	Mostly to Wet
910	CL	Mostly to Wet
920	CL	Mostly to Wet
930	CL	Mostly to Wet
940	CL	Mostly to Wet
950	CL	Mostly to Wet
960	CL	Mostly to Wet
970	CL	Mostly to Wet
980	CL	Mostly to Wet
990	CL	Mostly to Wet
1000	CL	Mostly to Wet

A hand-drawn stratigraphic column with the following layers from top to bottom:

- SANDY CLAY
- CLAY CLAY
- SANDY CLAY
- CLAYEY SAND
- SANDY CLAY

Horizon labels on the left side of the column:

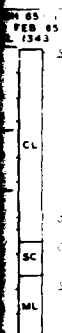
- CL (next to the second layer)
- SC (next to the fourth layer)
- ML (next to the fifth layer)

[illegible]

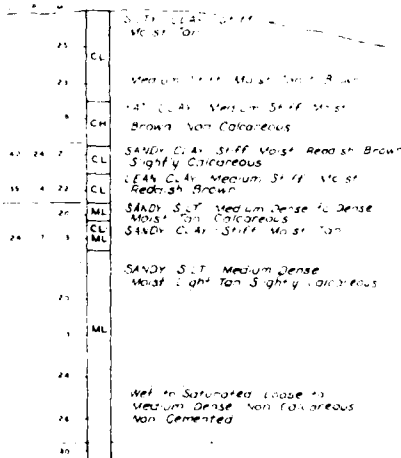
SCALE VERT 1 INCH = 10 FEET
HORIZ 1 INCH = 100 FEET



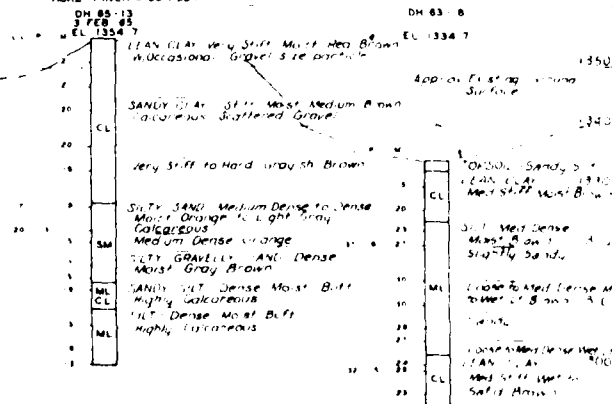
TEST IN K
 SCALE VERT 1 INCH = 10 FEET
 SCALE HORIZ 1 INCH = 50 FEET



DH 84 16
 30 DEC 84
 EL 1331.3



SECTION J J
 SCALE VERT 1 INCH = 10 FEET
 SCALE HORIZ 1 INCH = 50 FEET



SECTION I I
 SCALE VERT 1 INCH = 10 FEET
 SCALE HORIZ 1 INCH = 100 FEET

DH 85 16
 30 DEC 84
 EL 1331.3

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
 2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE AG.
 3. For Location of Borings, see PLATE A4.

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE AG.
3. For Location of Borings, see PLATE A4.

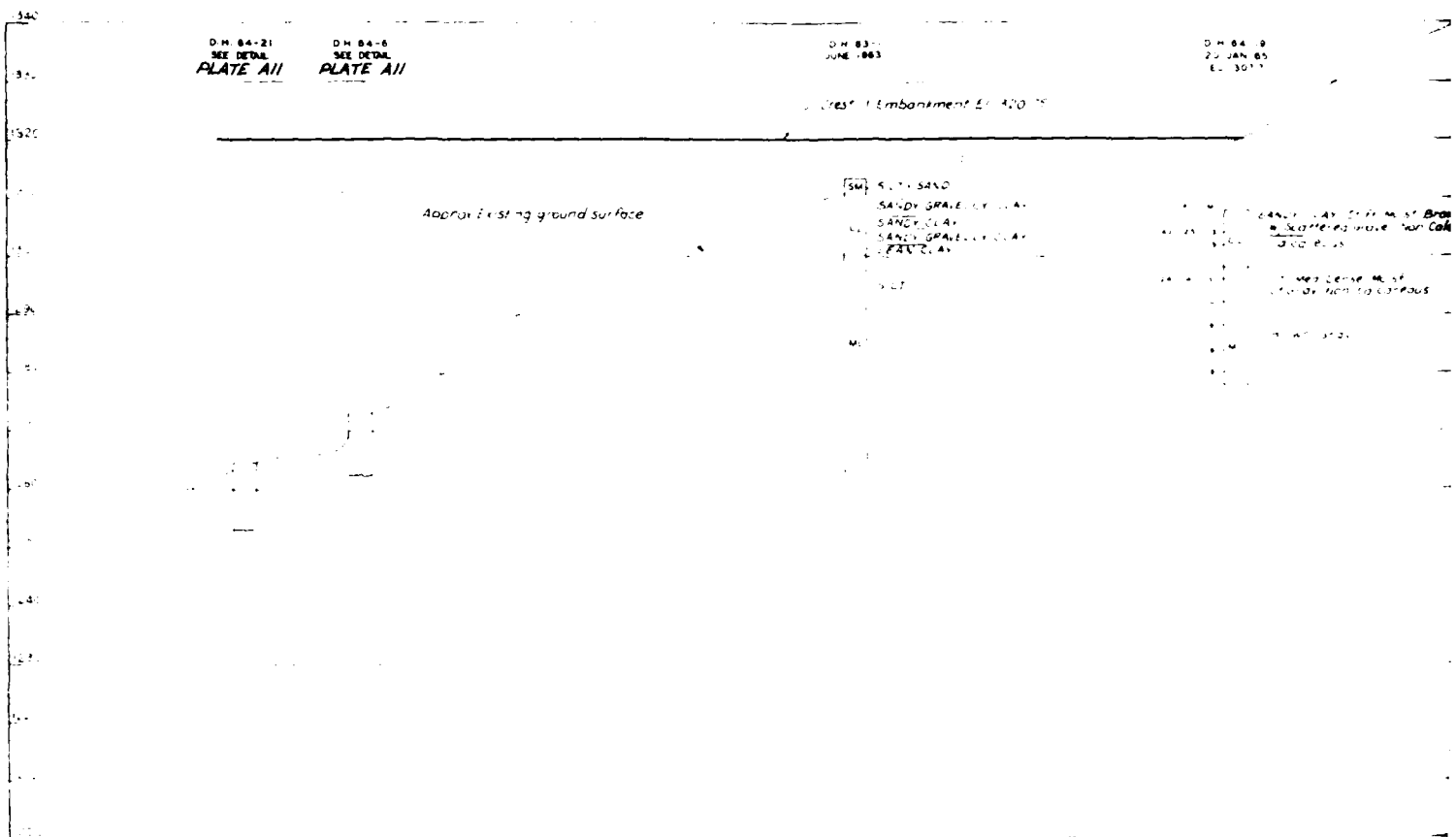
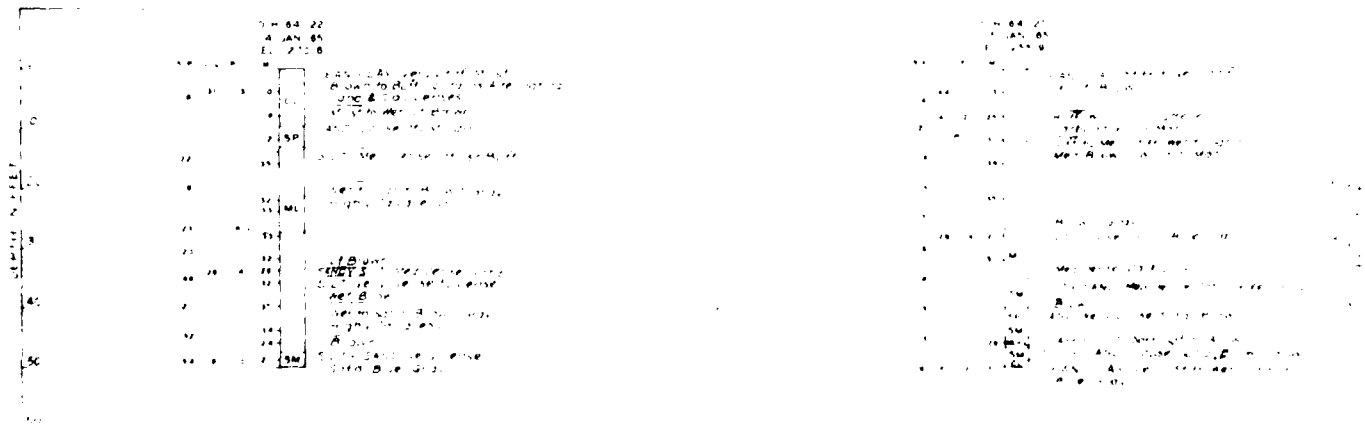


U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
 SITE NO 18
 RECORD OF BORINGS
 RIGHT ABUTMENT AREA
 SECTIONS II, J, J AND K K

DRAWING NO. 1100
 SCALE 1" = 100'
 DATE 110 000
 SHEET NO. 100-000
 PROJECT NO. 1100-000
 DRAWN BY [Signature]
 CHECKED BY [Signature]
 APPROVED BY [Signature]
 DATE 110 000
 SHEET NO. 100-000
 PROJECT NO. 1100-000
 DRAWN BY [Signature]
 CHECKED BY [Signature]
 APPROVED BY [Signature]
 DATE 110 000
 SHEET NO. 100-000
 PROJECT NO. 1100-000

CORPS OF ENGINEERS

[illegible]

EMBANKMENT

100 65 52
34 4.7, 985
6. 342

Crest of Embankment $EL: 420.35$

SM. S. L. V. SAND
SANDY GRAVELLY CLAY
LL. SANDY CLAY
SANDY GRAVELLY CLAY
LEAN CLAY

547

Hand-drawn stratigraphic column with depth markers on the left and soil descriptions on the right. The column is a vertical rectangle with a small 'CL' label inside. The depth markers are: 0, 25, 20, 10, 0, 10, 5, 5, 5, 5. The descriptions are: SANDY CLAY, stiff, med. s^t brown; w/ scattered gravel, non calcareous; SLT med dense, moist; LG Gray, non calcareous; Brown gr ss.

Depth (ft)	Soil Description
0 - 25	SANDY CLAY, stiff, med. s ^t brown; w/ scattered gravel, non calcareous
20 - 10	SLT med dense, moist
10 - 5	LG Gray, non calcareous
5 - 5	Brown gr ss

10	21	20	1000	1000
20	21	20	1000	1000
30	21	20	1000	1000
40	21	20	1000	1000
50	21	20	1000	1000
60	21	20	1000	1000
70	21	20	1000	1000
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860	21	20	1000	1000
870	21	20	1000	1000
880	21	20	1000	1000
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980	21	20	1000	1000
990	21	20	1000	1000
1000	21	20	1000	1000

SCALE: VERT. INCH = 0 FEET
HORIZ. INCH = 50 FEET

04 04 20
5 JAN 65
F 255 9

[illegible]

GENERAL INQUIRY

1. All elevations are in feet above
mean low water.

... .., Classification: f 30 13
... .., see PLATE A60

For a list of initials, see L.A. 44



U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
RIGHT ABUTMENT AREA

RECEIVED BY
 DATE BY
 TIME BY
 CHECKED BY
 SUBMITTED BY
 APPROVED BY
 SIGNED BY
 APPROVED BY

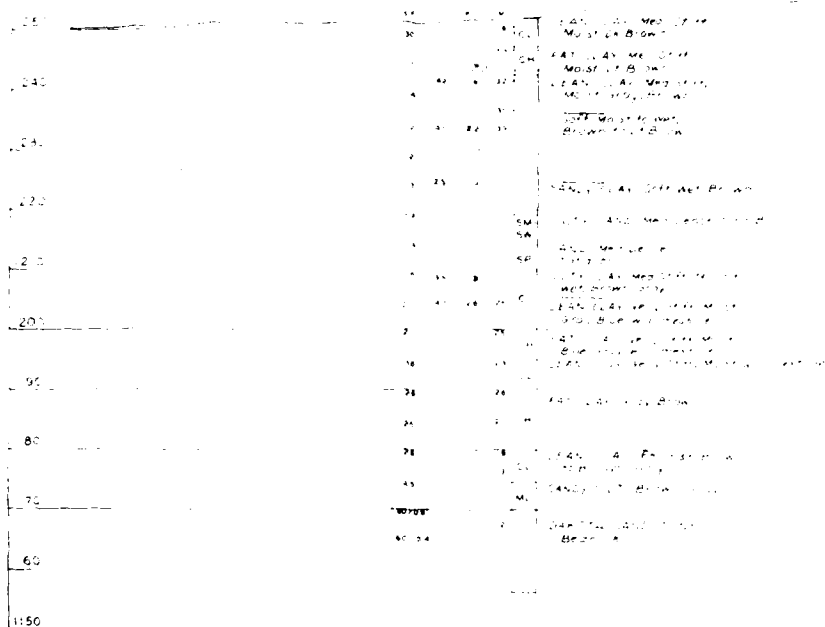
APPROVED: *Robert L. Gray* DATE: *10/11/77*
 CHIEF, COMMUNICATIONS SECTION
4 900 *10/11/77*
 MSC 13-310E 30

CORPS OF ENGINEERS

1 DE 1967
E 27 8

242
4. 201
1044

Approx. Existing Ground Surface



SECTION E-E

SCALE VER. INCHES FEET
HOR. INCHES FEET

A 165 Micro-master Film or a Paper Reproducible Record
Copy Must Be Made Before Every Amendment and/or Modification

AMOUNT	DATE	DESCRIPTION	DATE
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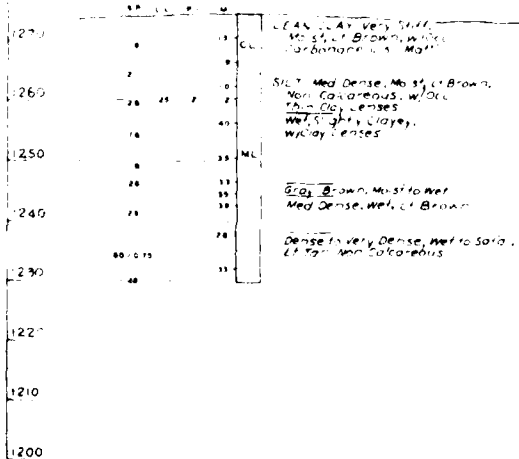
DH 05-1
2 FEB 1965
EL 12745

DW 84 B
SEE DETAIL 745 DWG

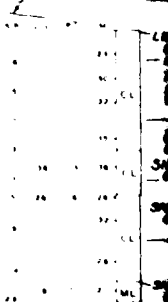
Embarkment

CH 65-2
 20 JAN 1985
 6 2450

UPSTREAM



Approx
Landing Ground



SECTION 7-4

SCALE VERT : 1 INCH = 10 FEET
HORIZ : 1 INCH = 20 FEET

DM 84-2
5 JAN 1985
EL 1264.4

DM 84-6
8 JAN 1984
EL 1265.2

SECTION E-E

round surface

Stiff

Stiff

Stiff

Stiff

Stiff

Stiff

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SECTION E-E
VERT. 1 INCH=10 FEET
SCALE HORIZ. 1 INCH=20 FEET

DM 84-8
DETAIL THIS DWG
& Embankment

DM 85-2
29 JAN 1985
EL 1265.0

DOWNSTREAM

Approx
Existing Ground Surface

LEAN CLAY, Very Stiff, No St.
Brown, w/ Scattered Carbonaceous
Material
Med Stiff, Moist, Brown,
w/ Scattered Carbonaceous Material
Wet
Brown Gray
Soft, Silty
Silty Clay, Soft to Med
Stiff, Silty, Brown Gray
SANDY CLAY, Med Stiff to Stiff,
Silty, Brown, Non Carbonaceous
SANDY SILT, Med Dense,
Brown, Non Carbonaceous

1290
1280
1270
1260
1250
1240
1230
1220
1210
1200

NOTES:

1. All elevations shown refer to feet above M.S.L. 1954 Gen. Adj.
2. For boring legend, classification of soils and descriptive notes, see PLATE A6.
3. For location of borings, see PLATE A4.

SECTION F-F

VERT. 1 INCH=10 FEET
SCALE HORIZ. 1 INCH=20 FEET



U. S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

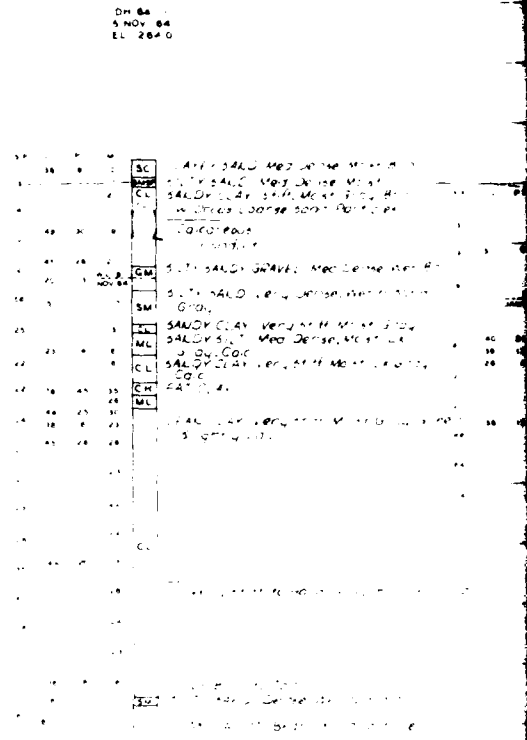
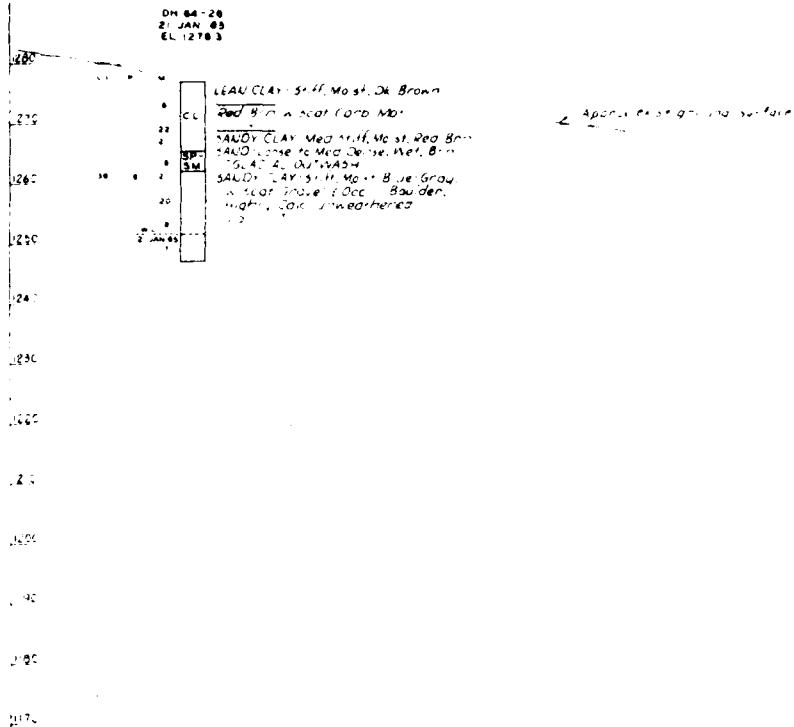
BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
RIGHT ABUTMENT AREA
SECTIONS E-E AND F-F

DATE
BY
CHECKED BY
APPROVED BY
DESIGNED BY
DRAWN BY
SCALE
SHEET NO. OF SHEETS

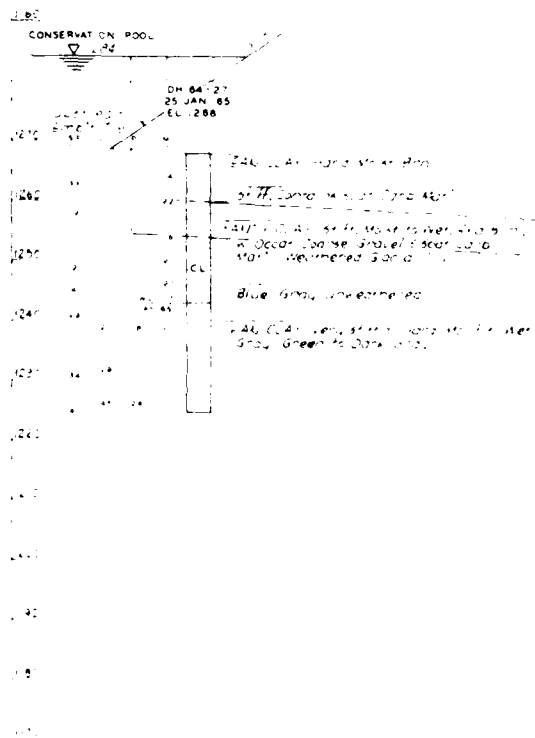
DATE
BY
CHECKED BY
APPROVED BY
DESIGNED BY
DRAWN BY
SCALE
SHEET NO. OF SHEETS

MSC13-310E31

CORPS OF ENGINEERS



A 105 Micromaster Film or a Paper Reproducible Record
 'y' Must Be Made Before Every Amendment and/or Modification



1. SECRET 2. SECRET

[illegible][illegible]

$\Delta_{\text{H}} = \frac{\Delta H}{T} - R \ln p$

[illegible]

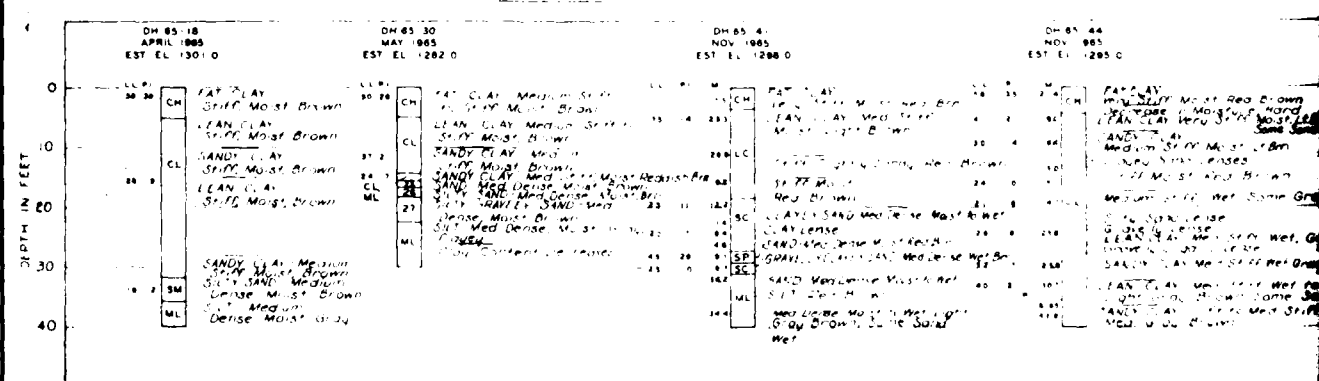
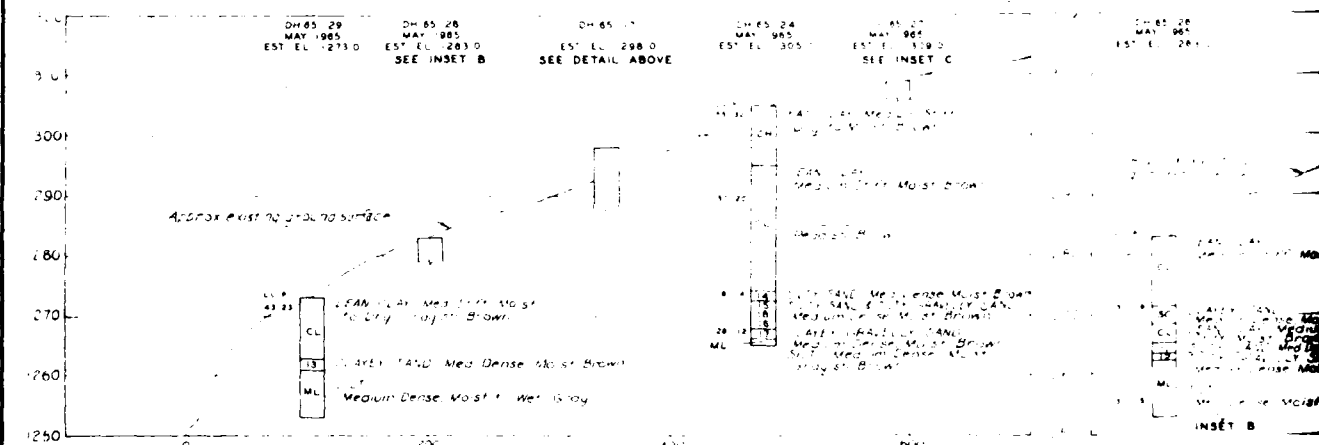
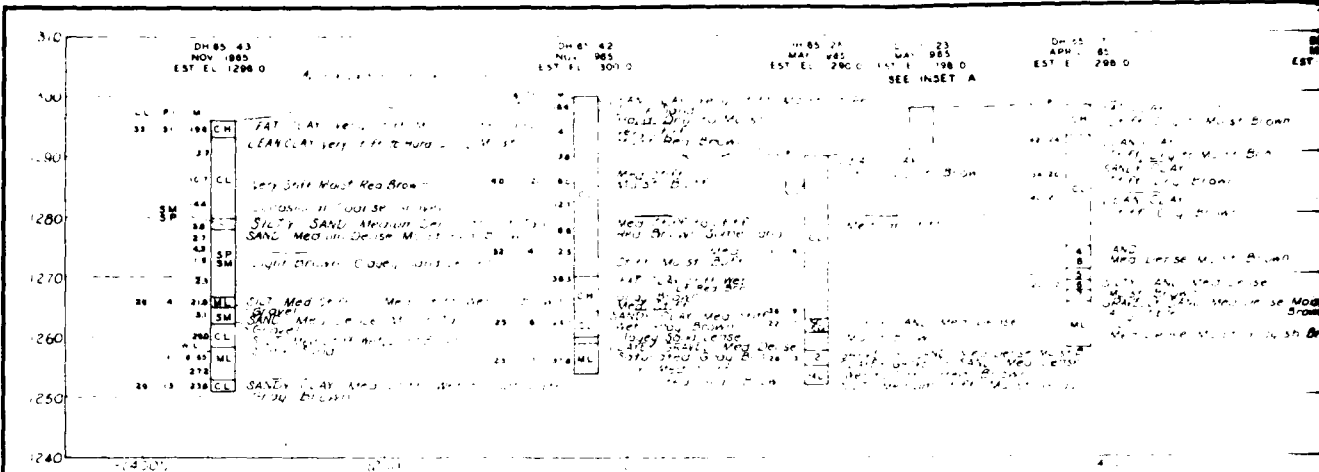
1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see Vol. A6
3. For location of borings see Vol. A4



BRANCHED OAK CAM AND LAKE
SITE NO 8
SECTION 4 E 10 R 10
T 11 N R 10 E 10 A
SECTION 4 E 10 R 10

MSC 13 - 310E 32

CORPS OF ENGINEERS



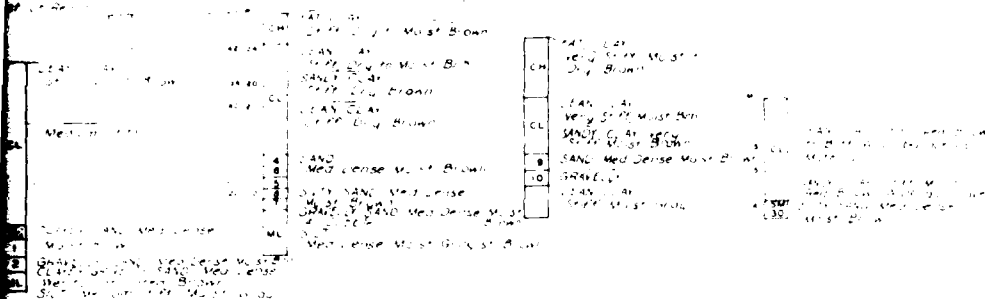
A 100 Micrometer Run or a New Microscopic Test
 Only Must Be Made Before Every Acquisition of Soil
 Sample

DN 24 MAY 1985
EST. EL. 1280.0
SEE INSET A

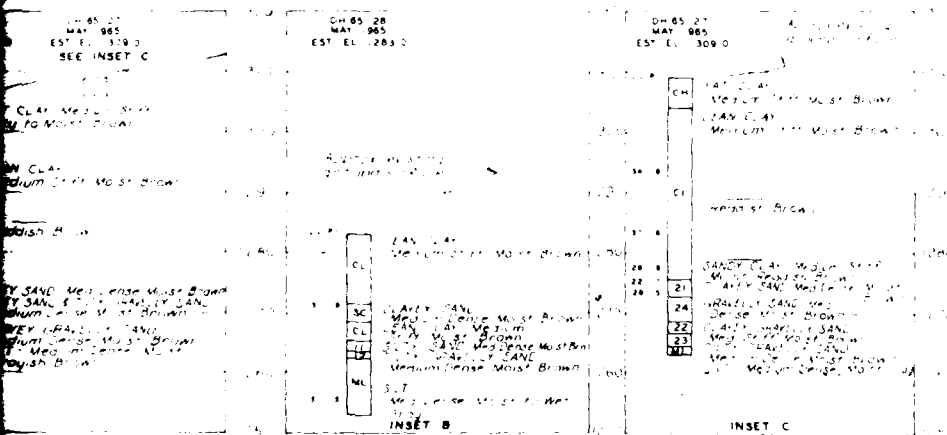
DN 25 MAY 1985
EST. EL. 1280.0

DN 25 MAY 1985
EST. EL. 1284.0

DN 26 MAY 1985
EST. EL. 1284.6



INSET A



INSET B

INSET C

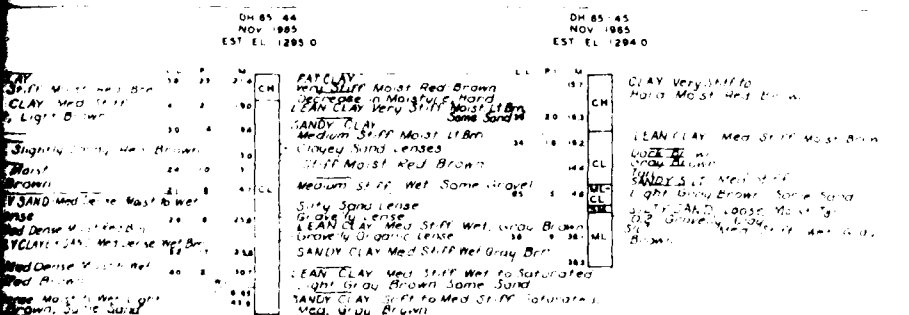
SAMPLE NO.	PLASTICITY INDEX (P.I.)	U.S. STANDARD SIZE	GRAVEL		SAND		CLASSIFICATION
			PERCENT	PERCENT	PERCENT	PERCENT	
1	20	23	12	22	66	56	CLAYEY SAND SP-SH
2	30	71	99	100			CLAYEY SAND SC
3	8	34	87	93			SAND SP-SH
4	1	93	100				SAND SP
5	70	1	1	99	100		SILTY SAND SH
6	9	17	68	80		92	SILTY GRAVELLY SAND SH-SH
7	7	62	92	98		100	SAND SP-SH
8	7	39	87	96		100	SAND SP-SH
9	6	29	77	89		100	SAND SP-SH
10	22	73	93	97		100	SAND SP-SH
11	10	26	58	87		96	SILTY GRAVELLY SAND SH-SH
12	1	88	99	100			CLAYEY SAND SC-SH
13	30	1	1	99	100		SILTY SAND SH
14	18	1	1	99	100		SILTY SAND SH
15	15	79	100				SILTY SAND SH
16	12	60	93	96		100	SILTY SAND SH-SH
17	28	12	12	62	73	90	CLAYEY GRAVELLY SAND SP
18	18	13	77	80		100	CLAYEY GRAVELLY SAND SH-SH
19	28	15	17	66	86	96	CLAYEY SAND SC
20	28	15	17	66	86	96	CLAYEY GRAVELLY SAND SP
21	13	18	46	75		90	SILTY GRAVELLY SAND SH
22	8	18	78	90		81	GRAVELLY SAND SH-SH
23	7	86	98	100			SAND SP-SH
24	15	99	100				SILTY SAND SH
25	18	13	68	80		92	SILTY GRAVELLY SAND SH
26	8	76	75	85		100	GRAVELLY SAND SH-SH
27	13	51	96	98		100	SILTY SAND SH
28	13	62	100				SILTY SAND SH

GENERAL NOTES:

- All Elevations shown refer to Feet above M.S.L., 1954 General Adjustment.
- For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A4.
- For Location of Borings, see PLATE A4.
- Estimated Elevations shown on Drill Holes are generally 5 Feet higher than the actual Elevation of the top of ground.

NOTES:

- The number in the Logs refer to the sample numbers of coarse grained material tested and presented in this tabulation.
- The Laboratory Classification of the Clay Soils above the pervious stratum was primarily Lean Clay with some Fat Clay.



SCALE: VERT. 1 INCH = 10 FEET
HORIZ. 1 INCH = 50 FEET



U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
LEFT ABUTMENT AREA
SECTIONS L-L AND M-M

By: [Signature]
Checked: [Signature]
Date: [Date]

FILE NO.

MSC13-310E33

1. 1000 4
 2. 1000 4
 3. 1000 4

[illegible]

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2818

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[illegible]

EMBA

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361	362	363
364	365	366
367	368	369
370	37	

1. ΔA der Step 1 ist 0, weil
 $\Delta A = \Delta A_{\text{Step 1}} + \Delta A_{\text{Step 2}}$
 $\Delta A = 0 + \Delta A_{\text{Step 2}}$
 $\Delta A = \Delta A_{\text{Step 2}}$
 2. ΔA der Step 2 ist 0, weil
 $\Delta A = \Delta A_{\text{Step 1}} + \Delta A_{\text{Step 2}}$
 $\Delta A = \Delta A_{\text{Step 1}} + 0$
 $\Delta A = \Delta A_{\text{Step 1}}$

2465 3
3 FEB 64
6-28-64

1. The first step is to identify the key components of the system. This includes understanding the hardware, software, and data involved. It also involves identifying the users and their roles.

SCALE VERT. INCH = 10 FEET
HORIZ. INCH = 100 FEET

0405 15
29 APRIL 85
14 303 EST

20 APR 64
1 12 15

DMB: 1P
 2 MAY 76
 (11290155)

29. [illegible]
30. [illegible]
31. [illegible]

[illegible]

0-05-37
7 MAY 65
1 200 051

36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1043 1044 1045 1046 1047 1048 1049 1050 1051 1052 1053 1054 1055 1056 1057 1058 1059

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GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE A6.
3. For Location of Borings, see PLATE A4.



U. S. ARMY ENGINEER DISTRICT. OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

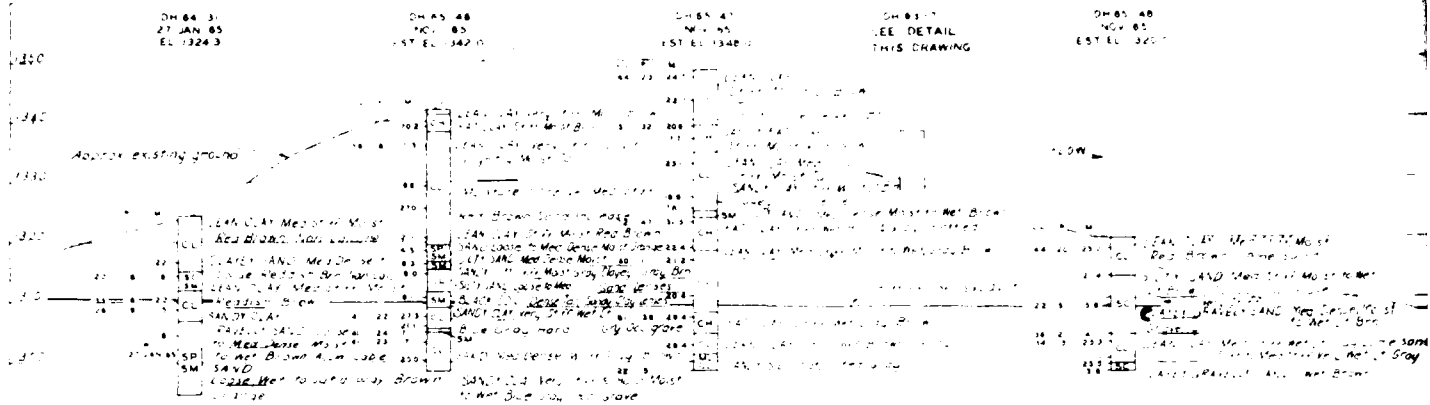
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THROUGH BY
CONTROLLED BY
QUALIFIED BY
NOTED BY
APPROVED
DATE FOR
APPROVED

BRANCHED OAK DAM AND LAKE
SITE NO 18
RECORD OF BORINGS
UPSTREAM BORROW AREAS

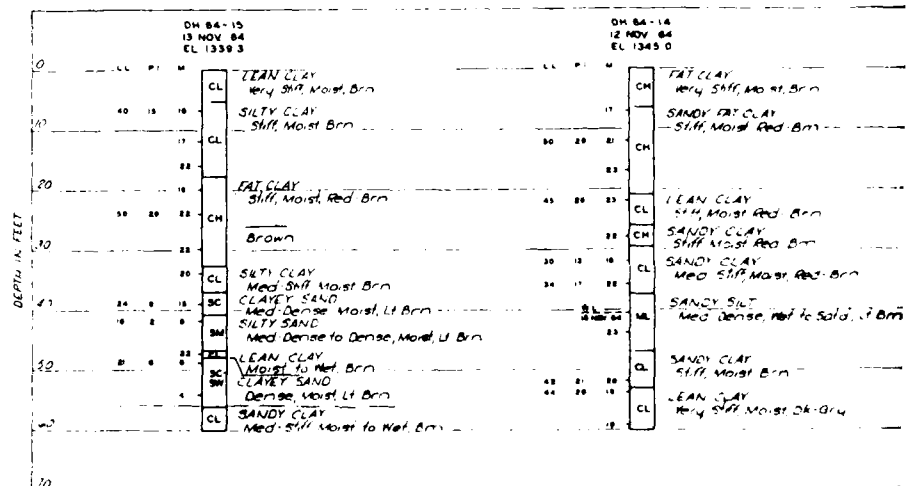
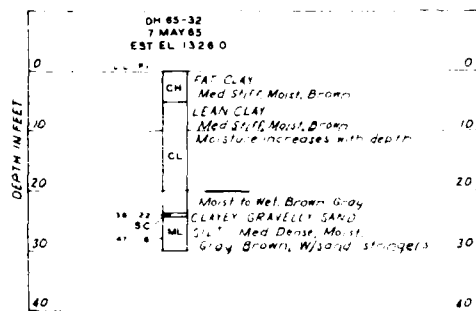
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DATE
SPEC. NO. AND NO. DATA

MSCI-310E 34

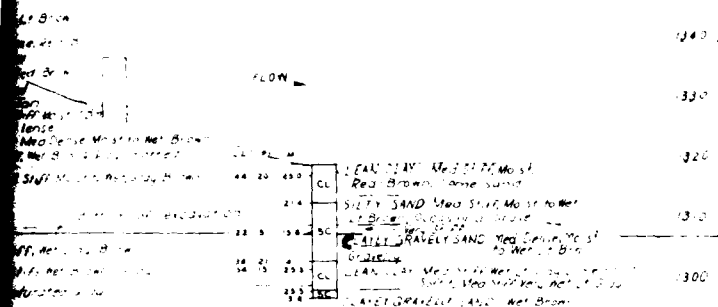
CORPS OF ENGINEERS



SPILLWAY CENTER, NE
 VERT. 1 INCH = 10 FEET
 SCALE
 HORIZ. 1 INCH = 100 FEET

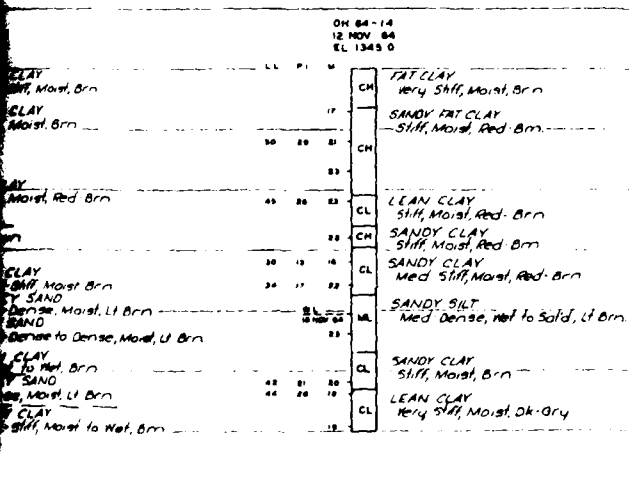


EST. E. 13M
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PLINE

NO FURTHER



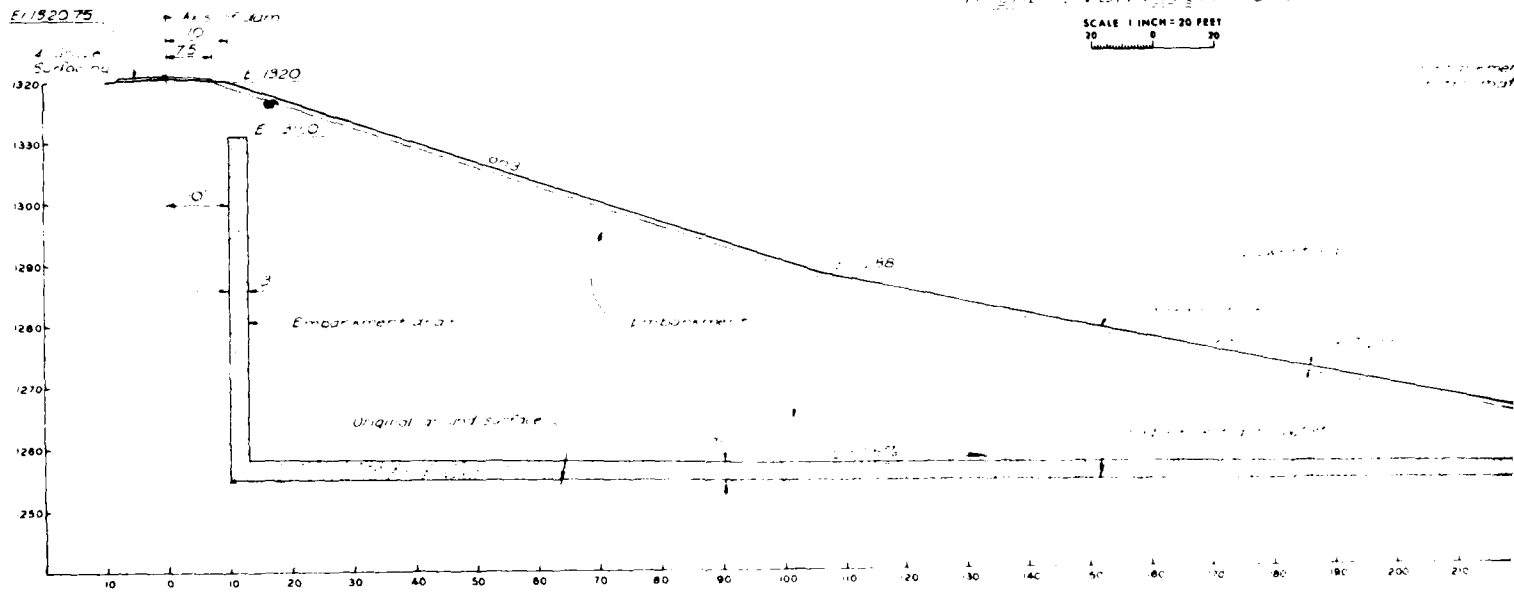
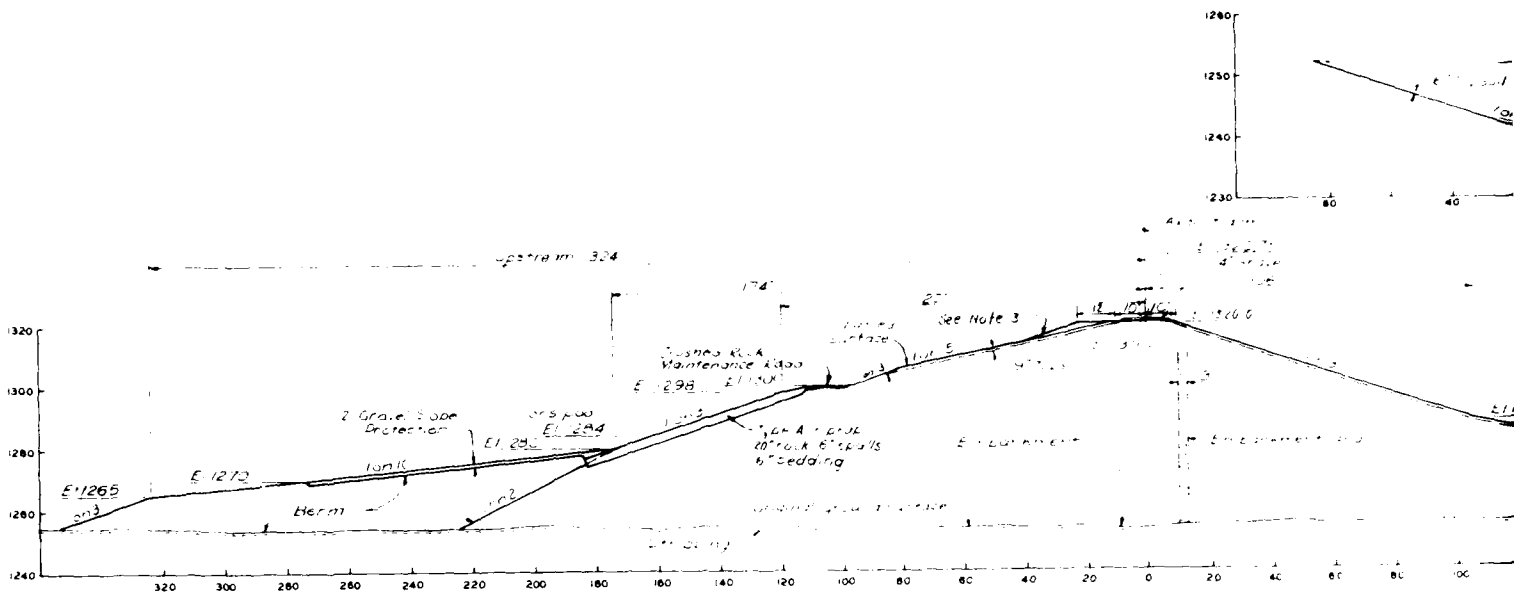
GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 Gen. Adj.
2. For Boring Legend, Classification of Soils and Descriptive Notes, see PLATE AG.
3. For location of Borings, see PLATE A4.



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY _____ DRAWN BY _____ CHECKED BY _____ INCHES BY _____ APPROVED <i>[Signature]</i> DATE FEB 1966	CAL. "OFF" "UP" "DOWN" "FLIP" "SPRIG" BRANCHED OAK DAM AND LAKE SITE NO 18 RECORD OF BORINGS SPILLWAY AREA DATE AS SHOWN _____ DRAWN BY _____ MISC13-310E35

CORPS OF ENGINEERS

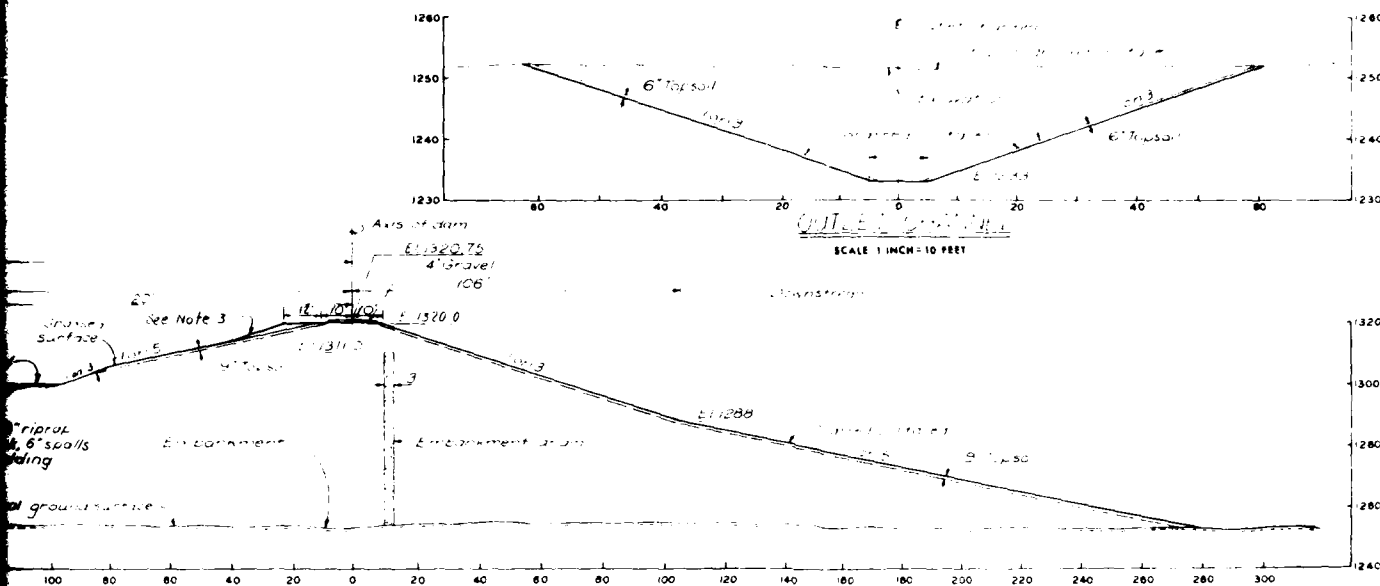


TYPICAL SECTION EMBANKMENT

SCALE 1 INCH = 10 FEET

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M.I
2.
19
3.

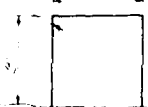
EMBANK



TYPICAL EMBANKMENT SECTION

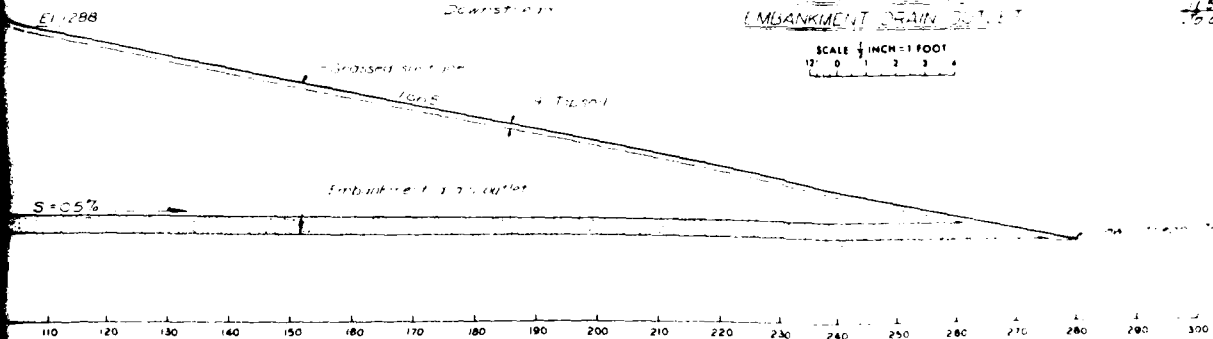
SCALE 1 INCH = 10 FEET

Embarkment drain
after project



TYPICAL SECTION EMBANKMENT DRAIN OUTLET

SCALE 1 INCH = 1 FOOT



TYPICAL SECTION EMBANKMENT DRAIN OUTLET

SCALE 1 INCH = 10 FEET

GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. This plate supersedes Plate 5 Appendix 'B' 1968 Inspection Report.
3. Crest width widened 12 feet in 1970.



THIS PLAN ACCOMPANIES CONTRACT NO. MODIFICATION NO.

DATE	DESCRIPTION	BY	DATE
U. S. ARMY ENGINEER DISTRICT OHAMA CORPS OF ENGINEERS OHAMA, NEBRASKA			
BRANCHED OAK DAM & RESERVOIR TYPICAL SECTIONS EMBANKMENT, EMBANKMENT DRAIN AND OUTLET CHANNEL			
DESIGNED BY	CHIEF OF DISTRICT	APPROVED	DATE
DRAWN BY			
CHECKED BY			
APPROVED			

CORPS OF ENGINEERS

UPSTREAM

12% gravel slope pro

Excavation

Embankment berm

Upstream

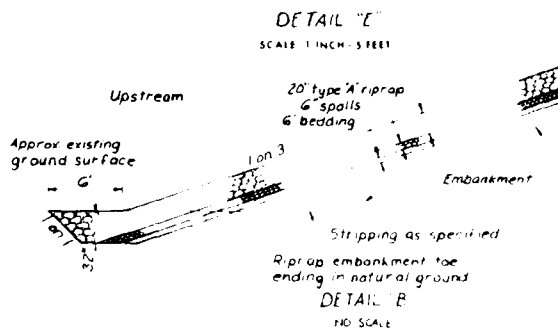
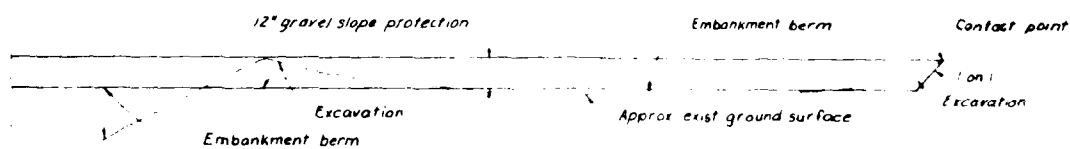
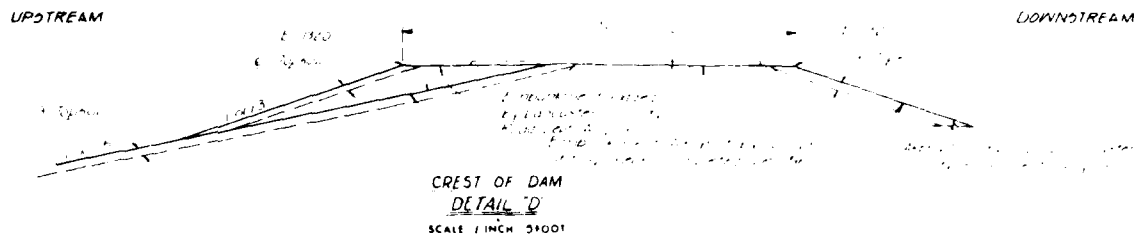
Approx existing
ground surface

Bedding
Gravel
Type 14 gravel

UPSTREAM

DETAIL "A"

EMBAN



GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of details, see PLATES A2 and A3.

DETAIL "A"
NO SCALE



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
BRANCHED OAK DAM AND LAKE SITE NO 18 EMBANKMENT SECTIONS AND DETAILS	
DESIGNED BY CHECKED BY APPROVED BY DATE	DATE FEB 1966 MSCL3-21020

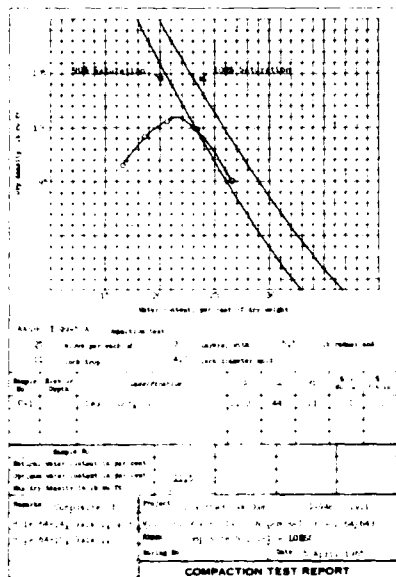


FIGURE 1

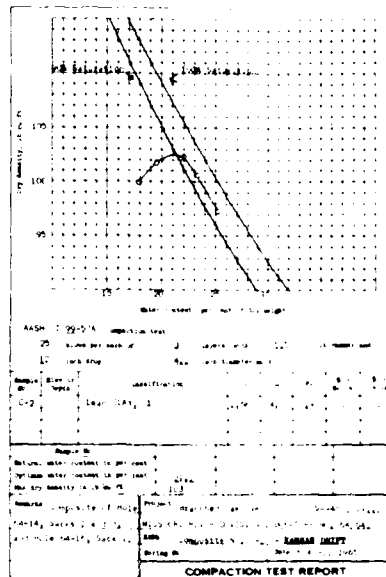


FIGURE 2

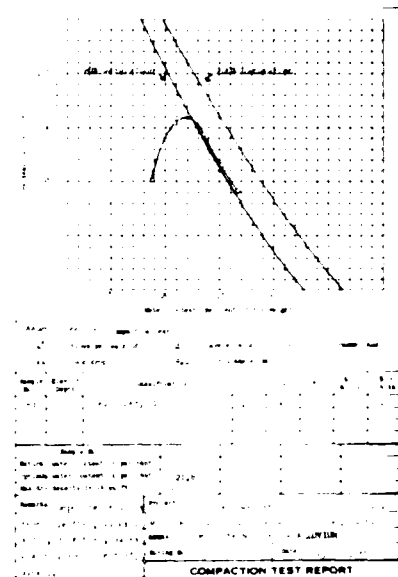


FIGURE 3

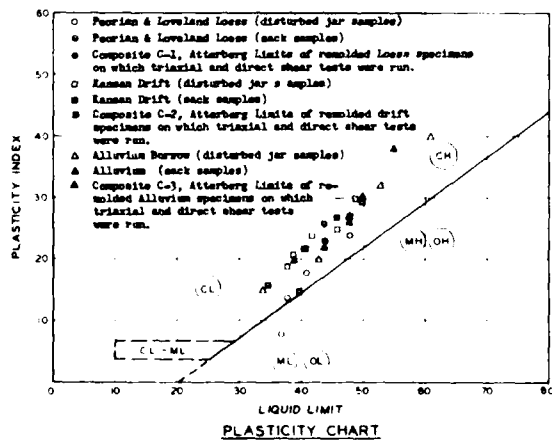


FIGURE 5

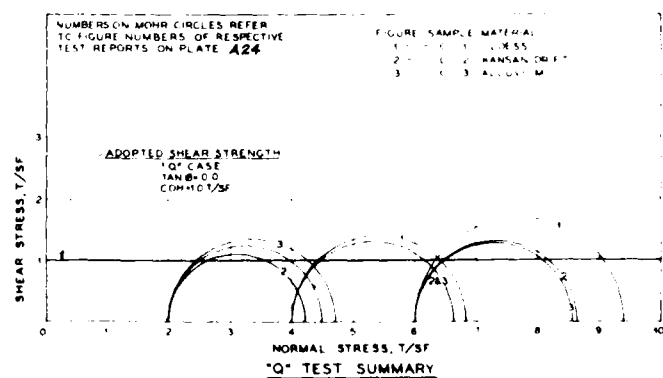


FIGURE 6

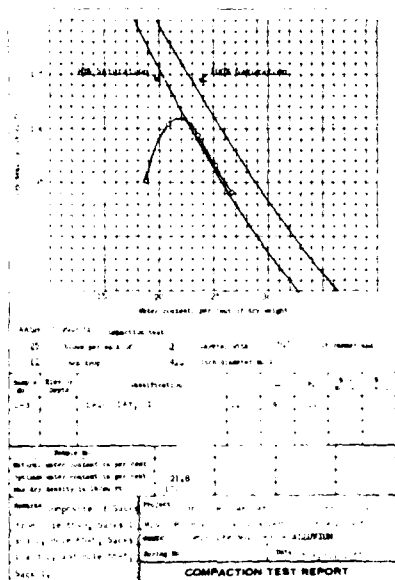


FIGURE 3

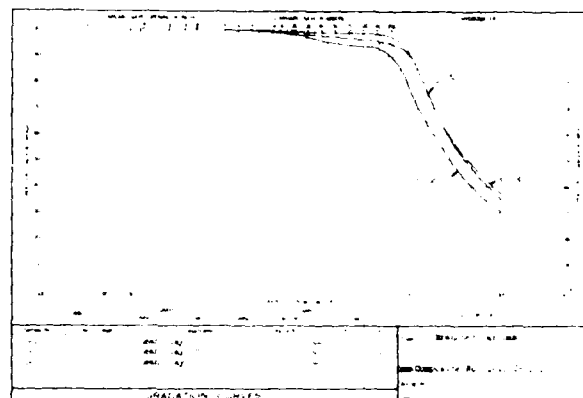


FIGURE 4

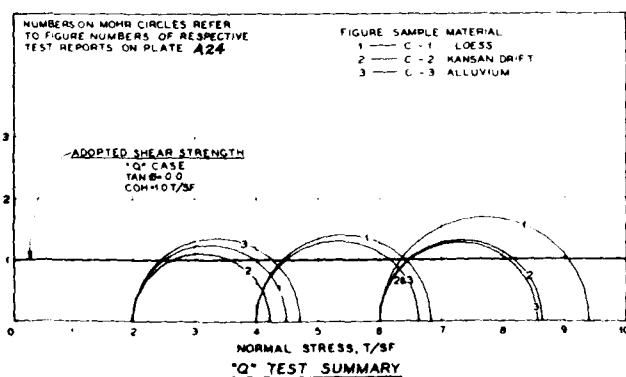


FIGURE 6

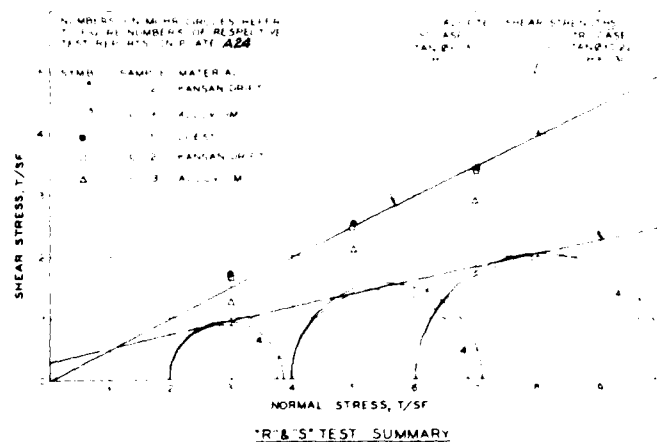


FIGURE 7



THIS PLAN ACCOMPANIES CONTRACT NO. DA-36-066-00
MODIFICATION NO.

DATE	DESCRIPTION	PAGE	APPROVED
	REL. 6-0-8		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA			
BRANCHED OAK DAM & RESERVOIR			
LABORATORY TEST DATA			
REMOLDED EMBANKMENT MATERIAL			
COMPACTION TESTS TRIAXIAL AND			
DIRECT SHEAR TEST SUMMARIES			
DESIGNED BY	CHECKED BY	DATE	
DR. J. H. H. H.	DR. J. H. H. H.	1983	
APPROVED BY		DATE	
DR. J. H. H. H.		1983	

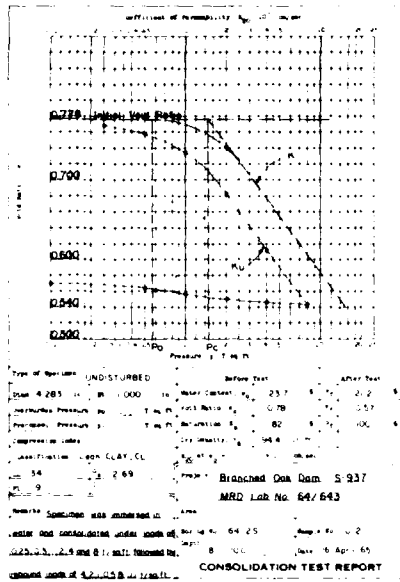


FIGURE 1

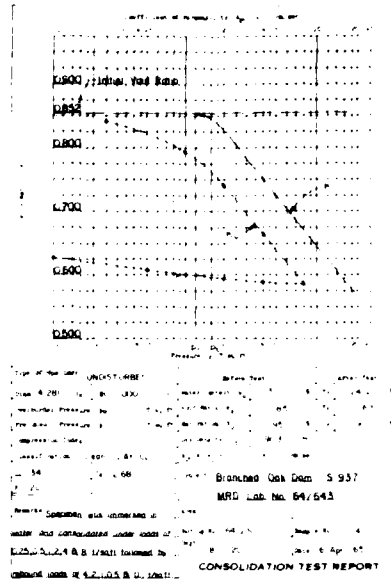


FIGURE 2

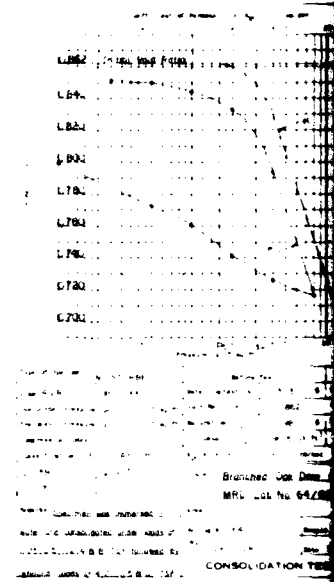


FIGURE 3

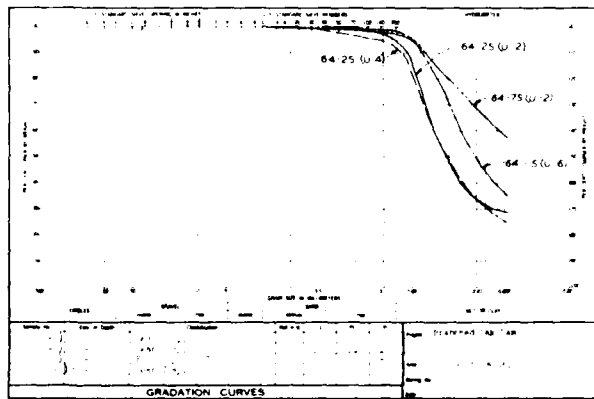


FIGURE 5

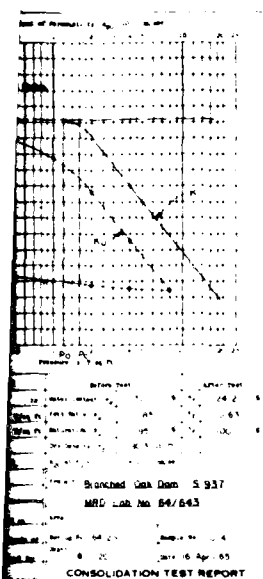


FIGURE 2

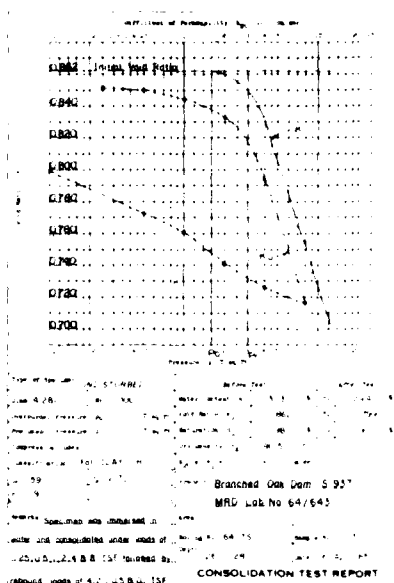


FIGURE 3

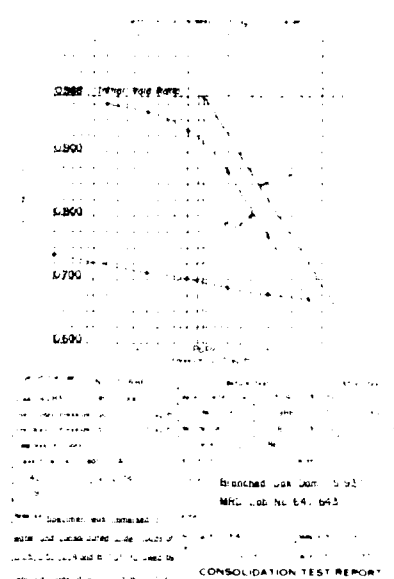


FIGURE 4



THIS PLAN ACCOMPANIES CONTRACT NO
OA-55-055-49
MODIFICATION NO

DATE	DESCRIPTION	DATE	APPROVED
	REV. 8-0-59		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM & RESERVOIR			
LABORATORY TEST DATA			
CONSOLIDATION TESTS FLOOD PLAIN ALLUVIUM			
TESTED BY <i>[Signature]</i>	DESIGNED BY <i>[Signature]</i>	DATE	SCALE
APPROVED BY <i>[Signature]</i>		DATE	SCALE

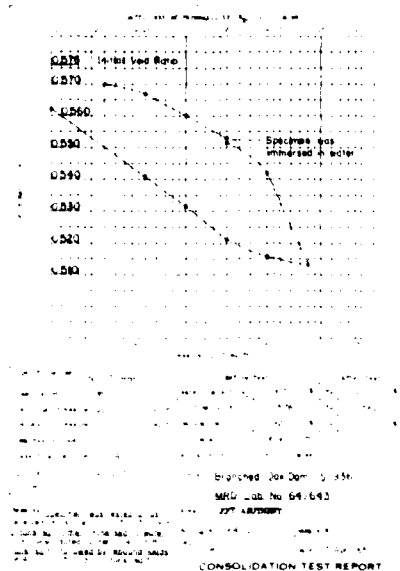


FIGURE 1

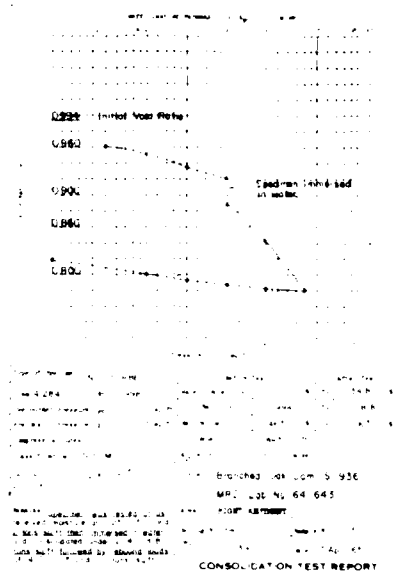


FIGURE 2

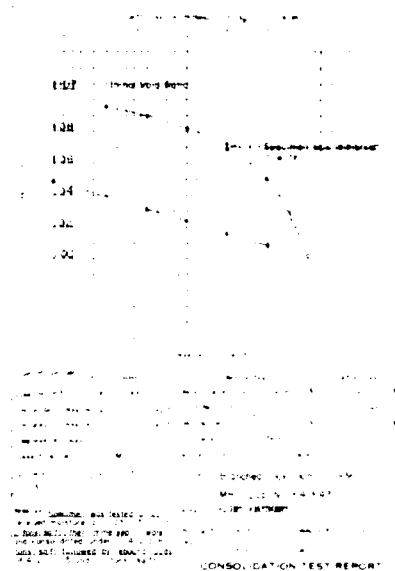


FIGURE 3

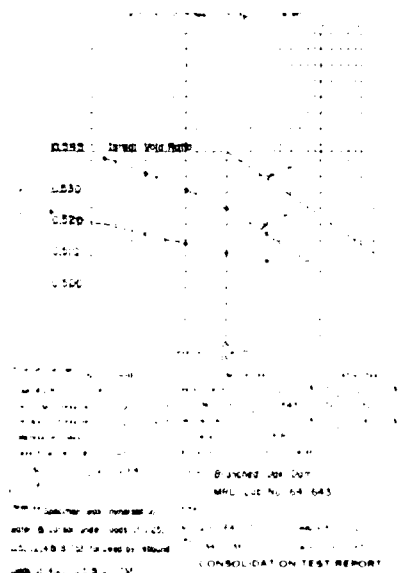


FIGURE 4

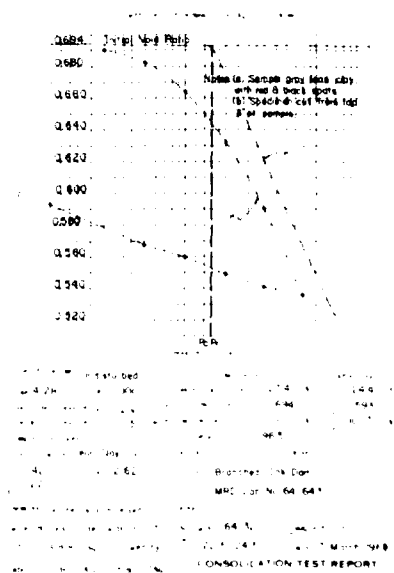


FIGURE 5

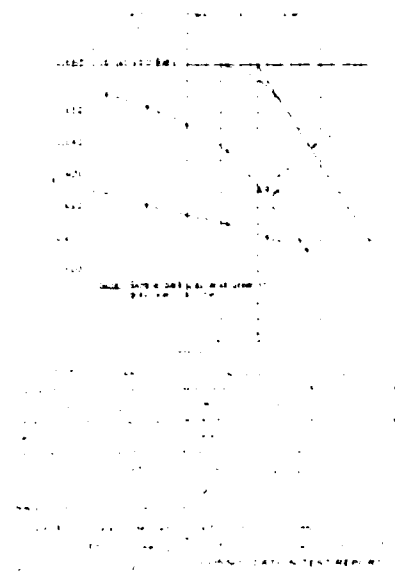
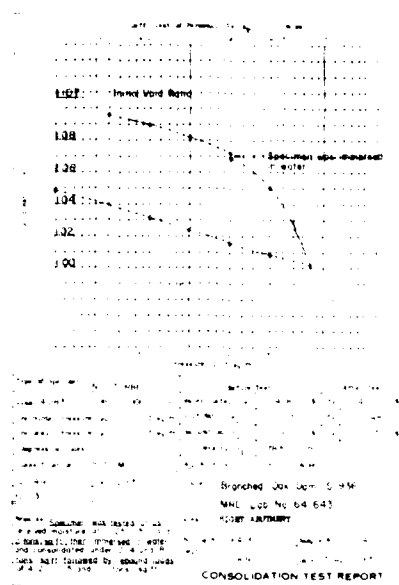
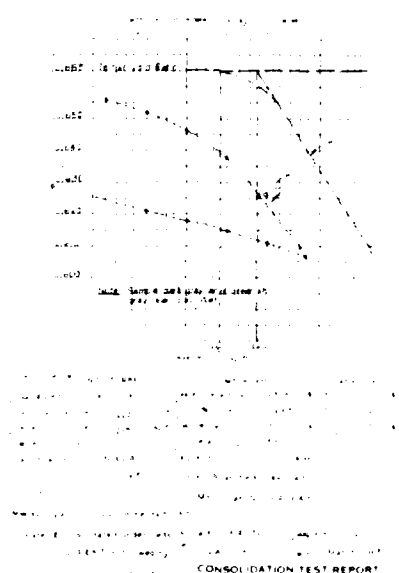


FIGURE 6

[illegible][illegible]

DATE _____ TELETYPE _____ DATE _____
 BY _____
 U. S. ARMY ENGINEER DISTRICT, OMAHA
 CORPS OF ENGINEERS
 OMAHA, NEBRASKA

SALT CREEK AND ITS TRIBUTARIES NEBRASKA
BRANCHED OAK DAM & RESERVOIR
 LABORATORY TEST DATA
 CONSIDERATION TESTS
 ABUTMENT AND OUTLET WORKS AREA

DESIGNED BY _____
 DRAWN BY _____
 CHECKED BY _____
 APPROVED BY _____
 DATE _____

APPROVED _____
 DATE _____

RECEIVED _____
 DATE _____



THIS PLAN ACCOMPANIES CONTRACT NO. DA 28 046 - MODIFICATION NO.

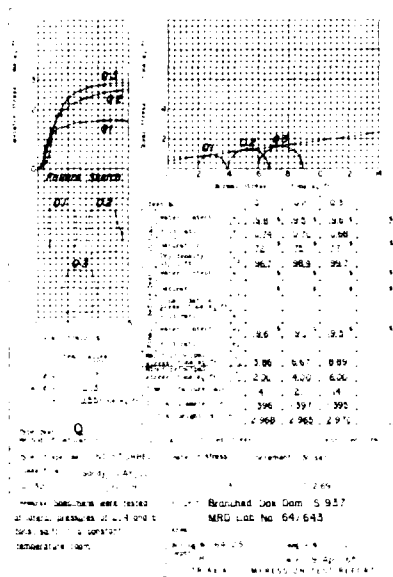


FIGURE 1

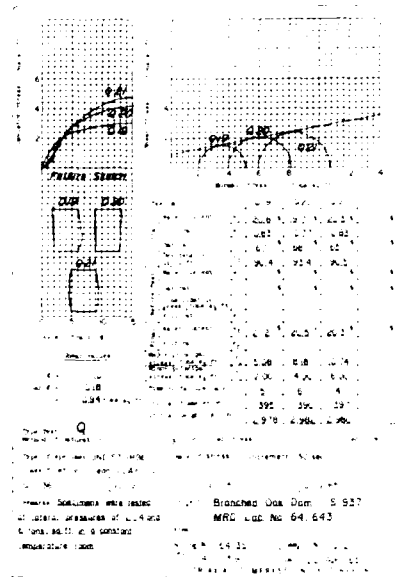


FIGURE 2

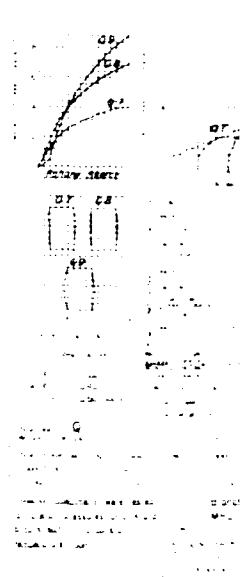


FIGURE 3

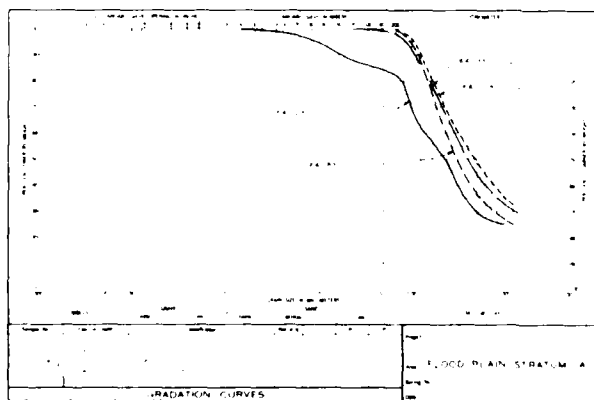


FIGURE 5

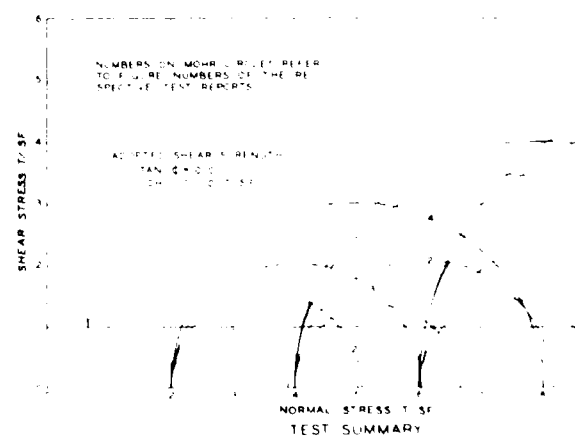


FIGURE 6

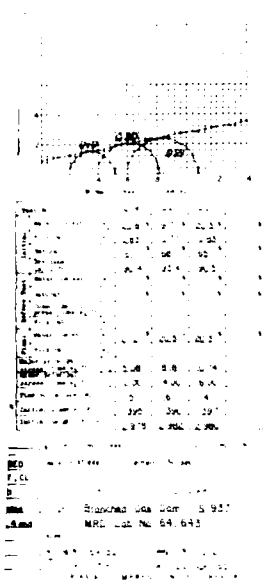


FIGURE 2

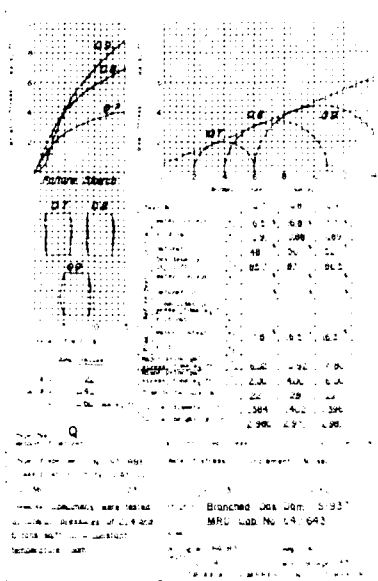


FIGURE 3

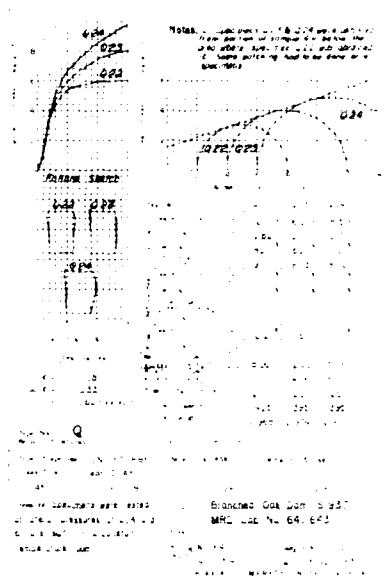


FIGURE 4

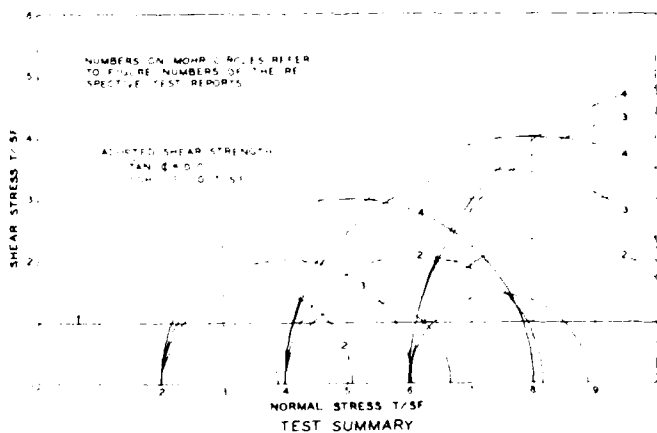


FIGURE 6



THIS PLAN ACCOMPANIES CONTRACT NO. DA-28-068-000 MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROVED
	REV. 10-68		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA			
BRANCHED OAK DAM & RESERVOIR			
LABORATORY TEST DATA			
UNCONSOLIDATED-UNDRAINED "Q" TESTS			
STR			

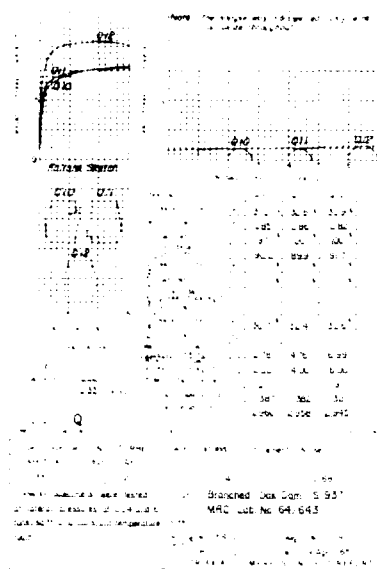


FIGURE 1

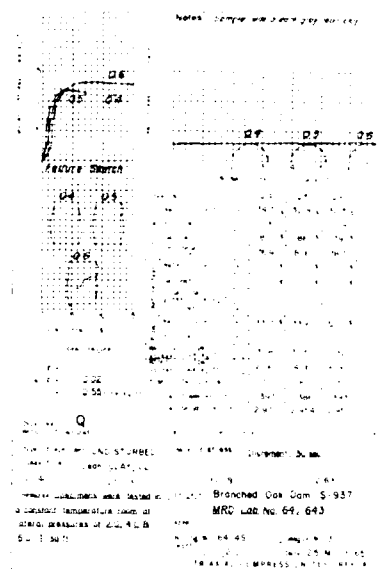


FIGURE 2

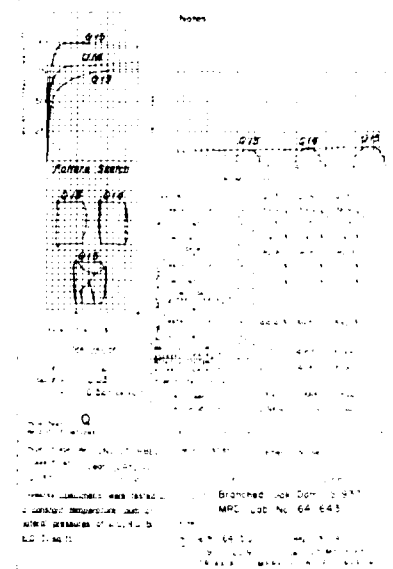


FIGURE 3

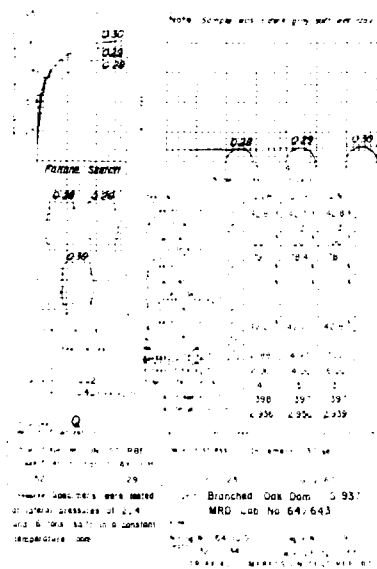


FIGURE 6

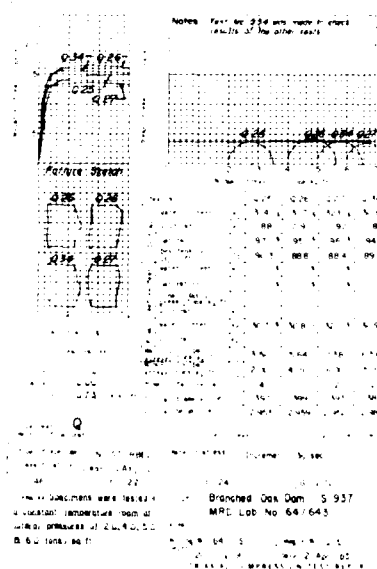


FIGURE 7

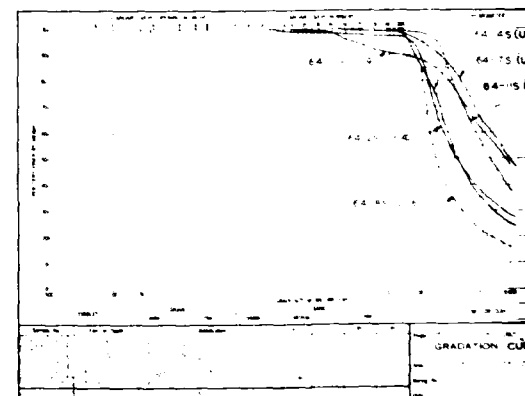


FIGURE 8

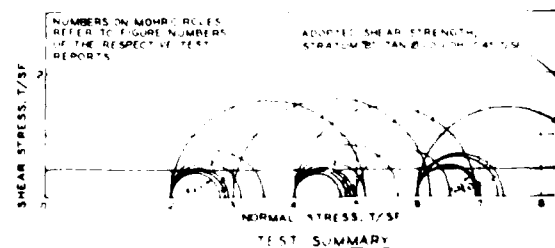


FIGURE 10

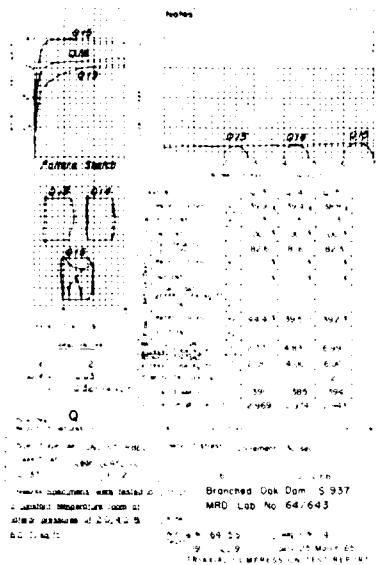


FIGURE 3

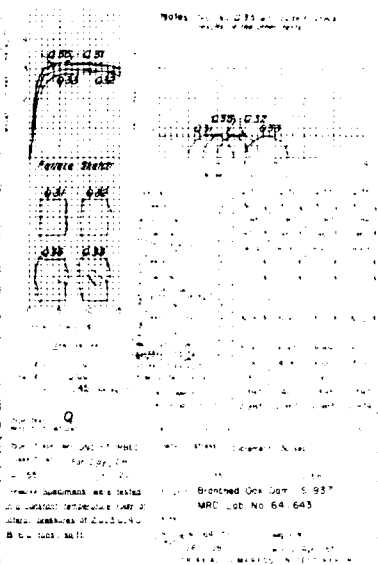


FIGURE 4

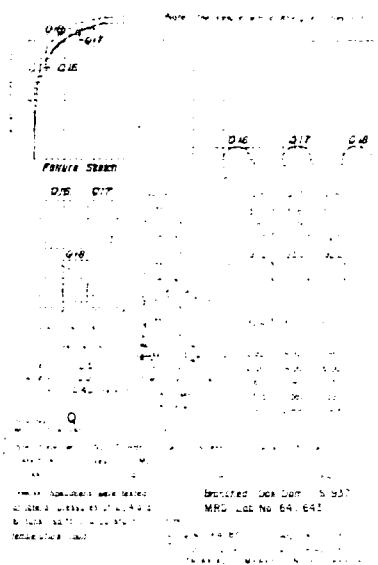


FIGURE 5

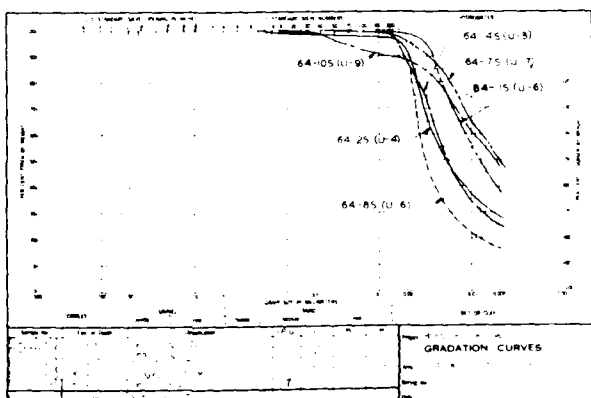


FIGURE 8

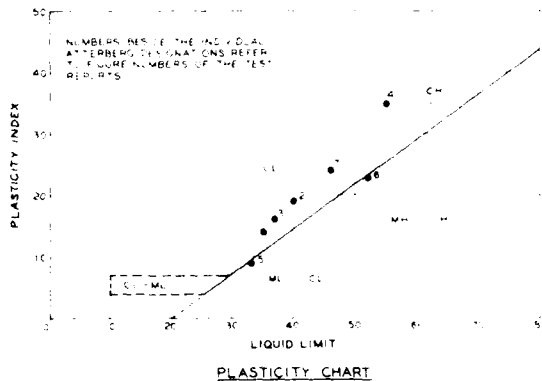


FIGURE 9

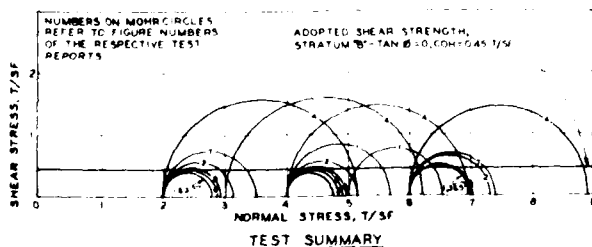


FIGURE 10



THIS PLAN ACCOMPANIES CONTRACT NO. DA-38-066 MODIFICATION NO.

DATE		DESCRIPTION		DATE		APPROVED	
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA							
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA							
BRANCHED OAK DAM & RESERVOIR							
LABORATORY TEST DATA							
UNCONSOLIDATED UNDRAINED Q-T TESTS							
STRATUM B							
DESIGNED BY	CHECKED BY	APPROVED BY	DATE	SCALE	DATE	SCALE	DATE
DR. J. L. HARRIS	DR. J. L. HARRIS	DR. J. L. HARRIS	10/1/55	1:1	10/1/55	1:1	10/1/55
DR. J. L. HARRIS							

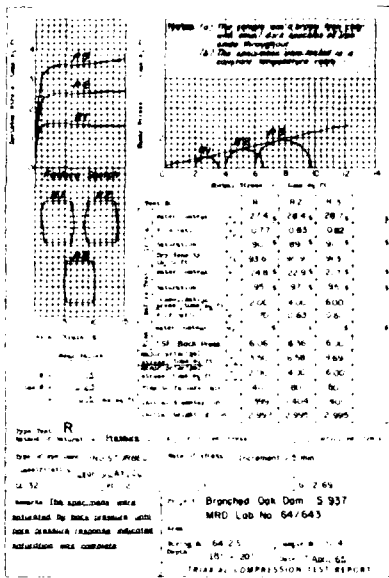


FIGURE 1

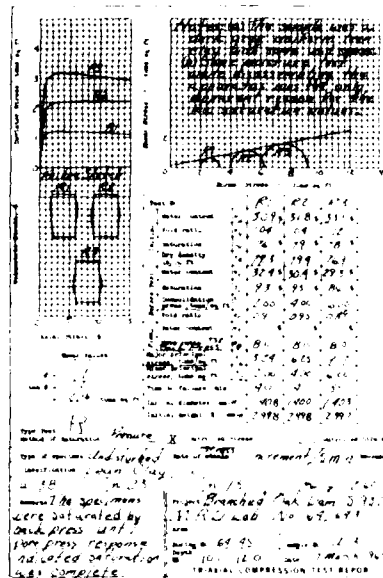


FIGURE 2

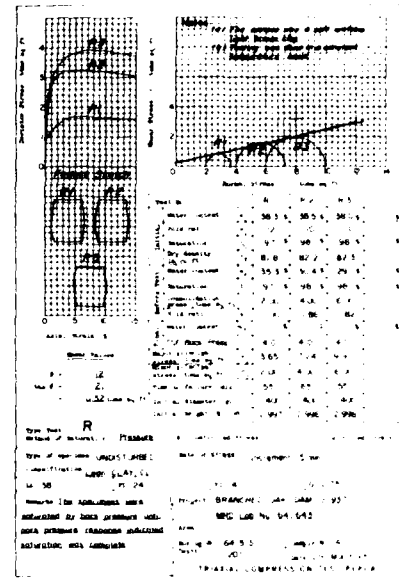


FIGURE 3

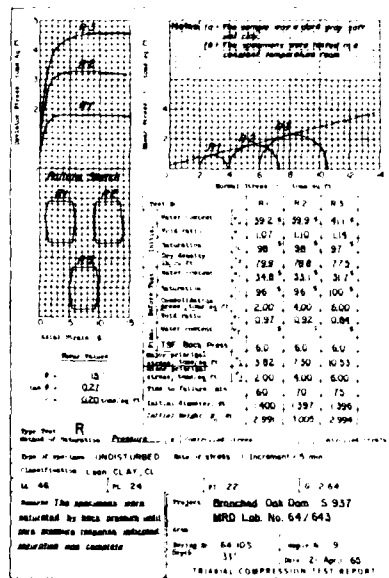


FIGURE 6

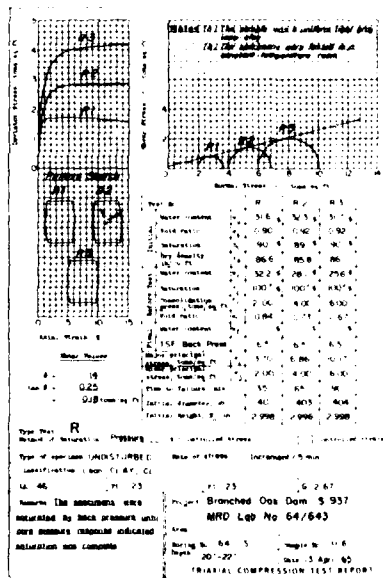


FIGURE 7

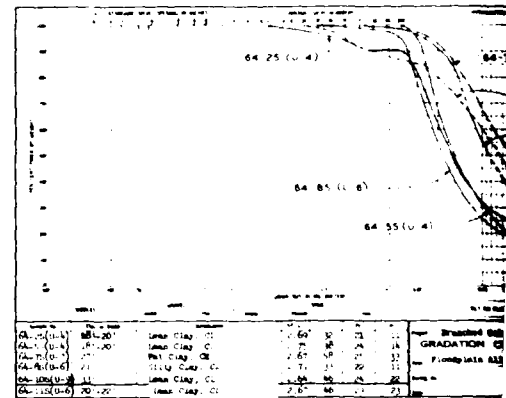


FIGURE 8

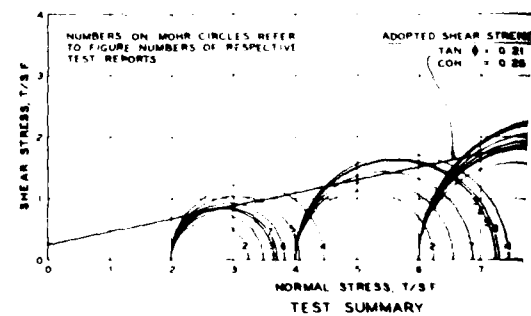


FIGURE 10

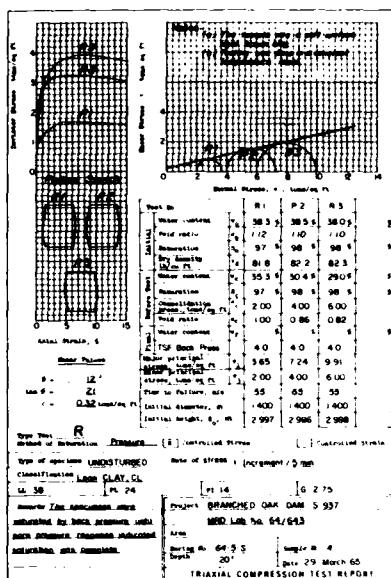


FIGURE 3

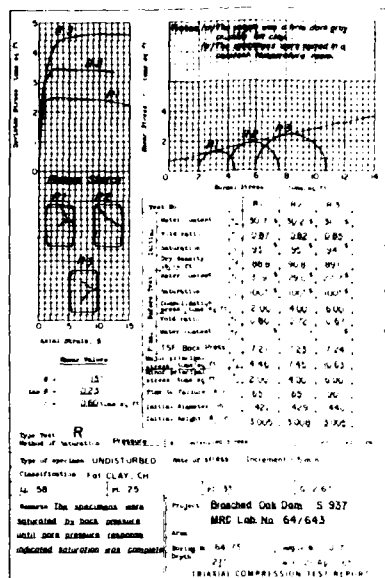


FIGURE 4

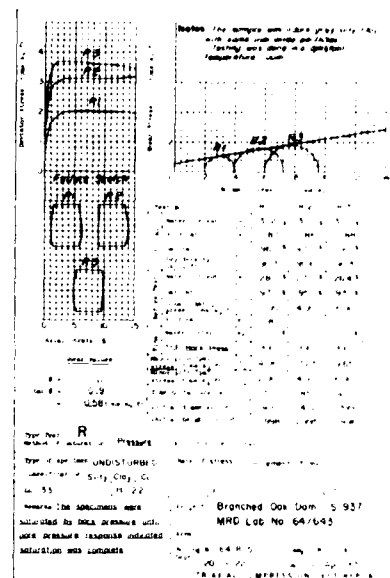


FIGURE 5

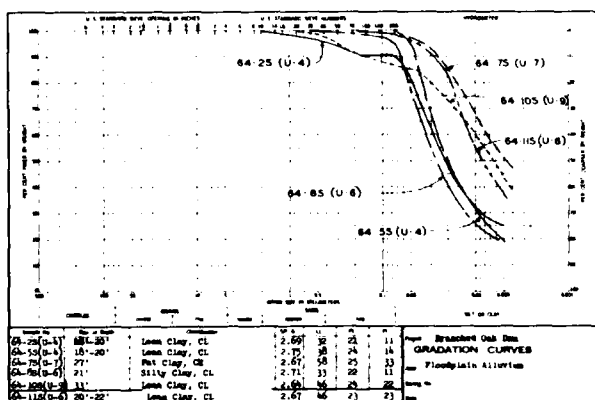


FIGURE 8

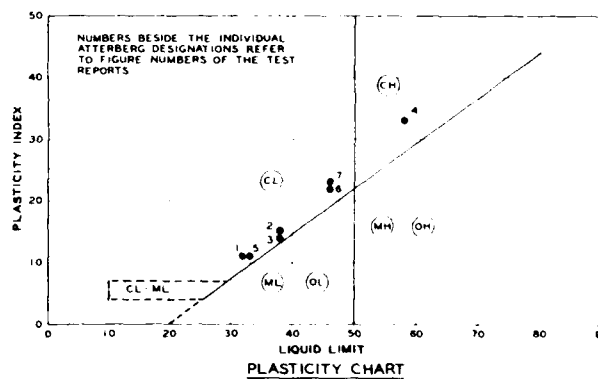


FIGURE 9

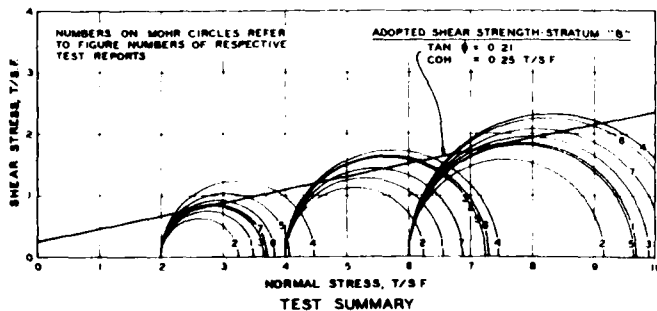


FIGURE 10



DATE	DESCRIPTION	NAME	ADDRESS
1964	REVISION		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
REVISION BY	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA		
DATE BY	BRANCHED OAK DAM & RESERVOIR		
THRU BY	LABORATORY TEST DATA		
REVISION BY	CONSOLIDATED - UNDRAINED "R" TESTS		
DATE BY	<i>W. S. [Signature]</i> 1000 10th St. S.E.		
APPROVED	<i>W. S. [Signature]</i> 1000 10th St. S.E.	DATE	JUNE 1964
APPROVED	<i>W. S. [Signature]</i> 1000 10th St. S.E.	DATE	JUNE 1964
<i>Harold J. [Signature]</i> 1000 10th St. S.E.		1000 10th St. S.E.	

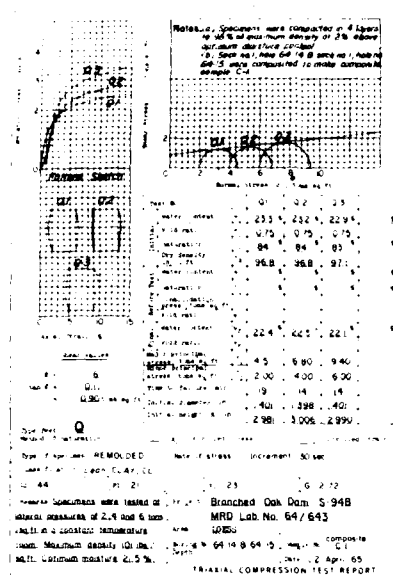


FIGURE 1

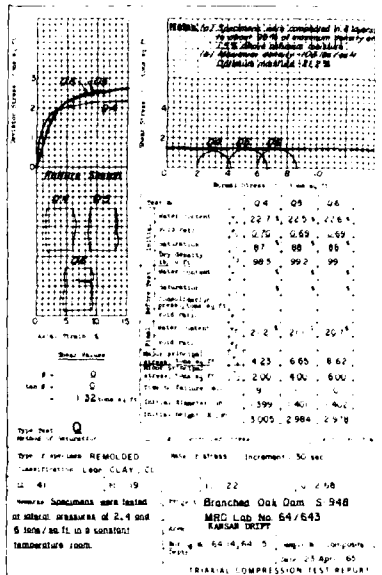


FIGURE 2

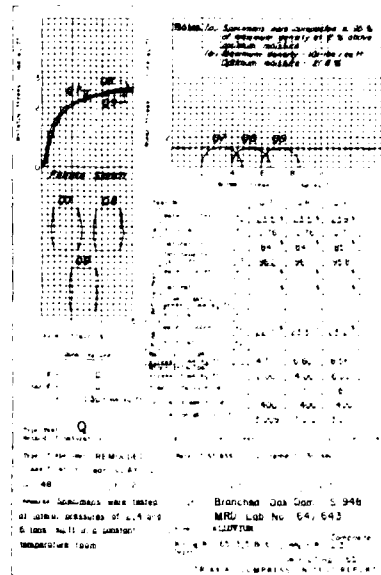


FIGURE 3

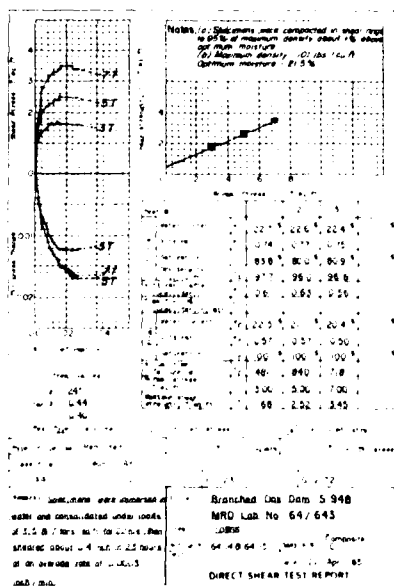


FIGURE 6

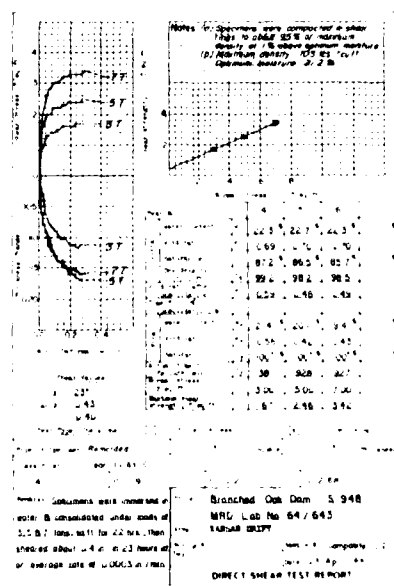


FIGURE 7

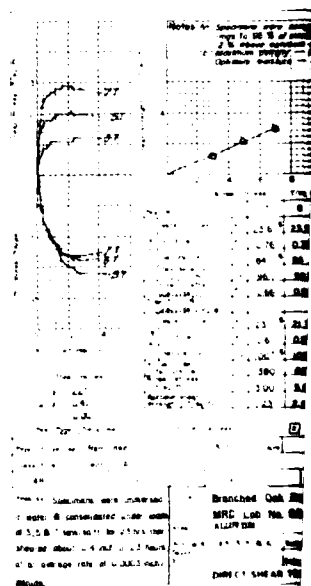


FIGURE 8

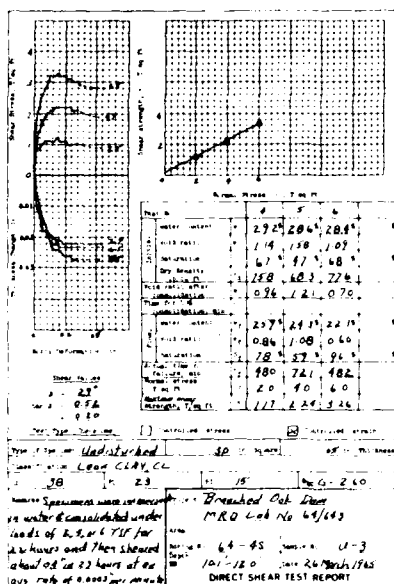


FIGURE 1

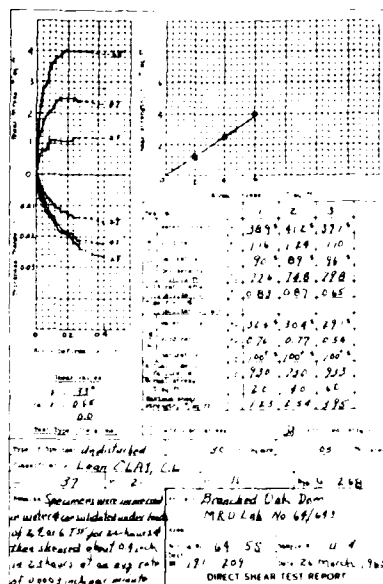


FIGURE 2

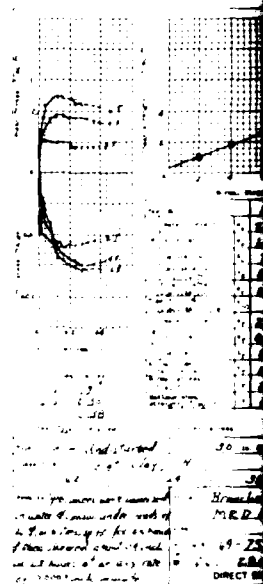


FIGURE 3

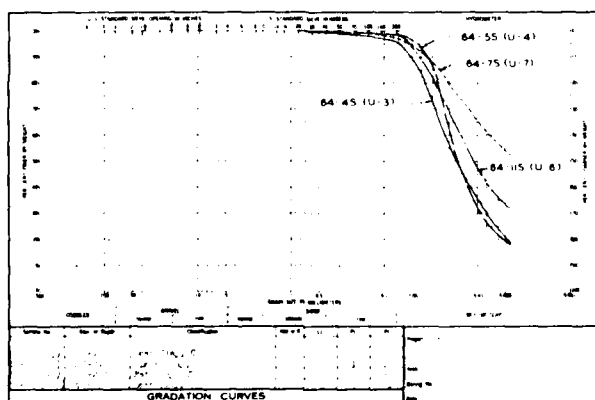
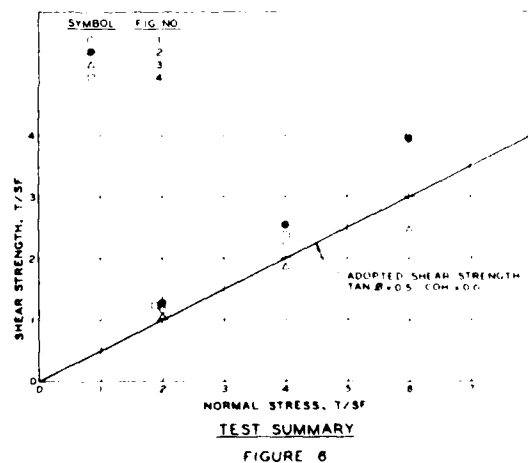


FIGURE 4



NOTE:

1. Test specimens were immersed in water and consolidated under loads of 2.5 or 6 T/SF for 22 hours and then sheared at about 0.4 in 23 hours at a rate of 0.0003 inch per minute.

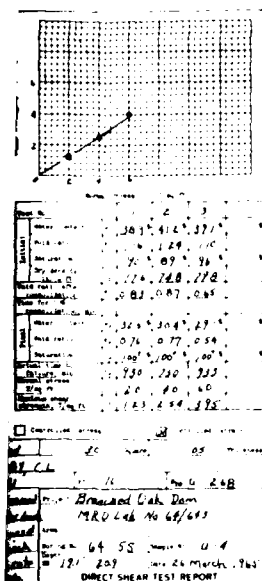


FIGURE 2

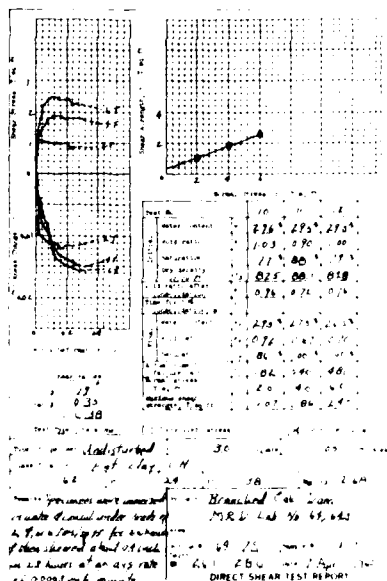


FIGURE 3

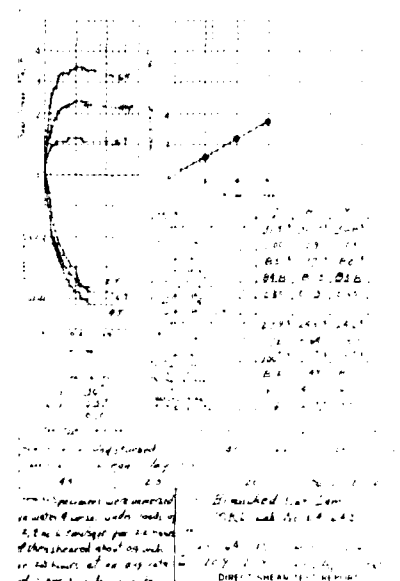
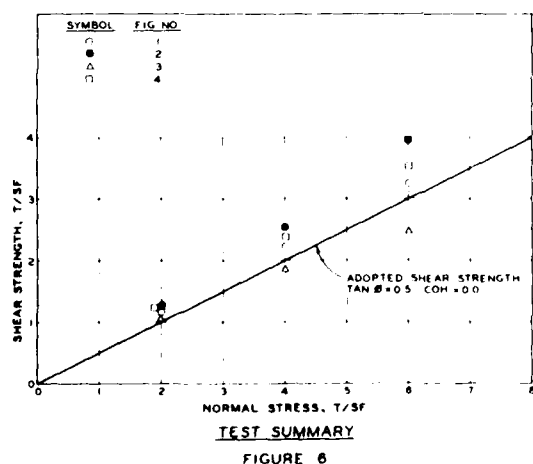
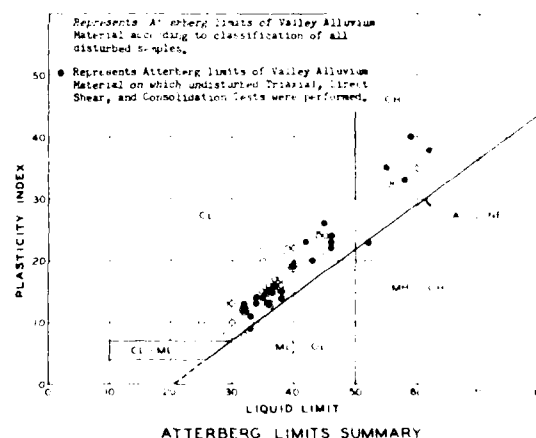


FIGURE 4



NOTE:

1. Test specimens were immersed in water and consolidated under loads of 2.4, or 6 T/5F for 22 hours and then sheared about 0.4° in 23 hours at an average rate of 0.0003 inches per minute.



DATE	DESCRIPTION	DATE	APPROVED
	AS-BUILT		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM & RESERVOIR			
LABORATORY TEST DATA DIRECT SHEAR "S" TESTS			
DESIGNED BY	CHECKED BY	DATE	
DR. H. H. H. H.	J. H. H. H.	1962	
APPROVED BY	DATE		
Harold J. H. H.	1962		

THIS PLAN ACCOMPANIES CONTRACT NO.
DA-38-066-400 MODIFICATION NO.

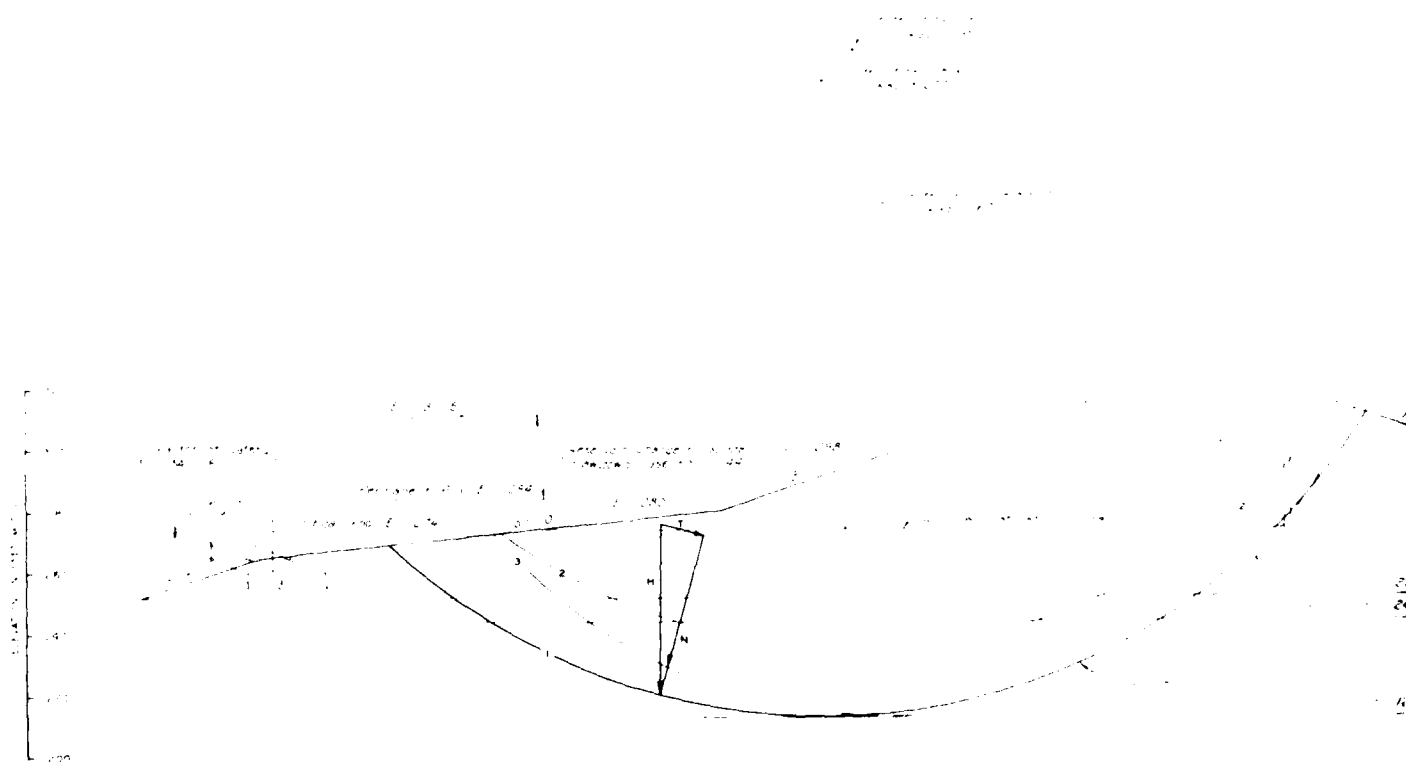
EMBANKMENT CRITERIA AND PERFORMANCE REPORT

(1983)

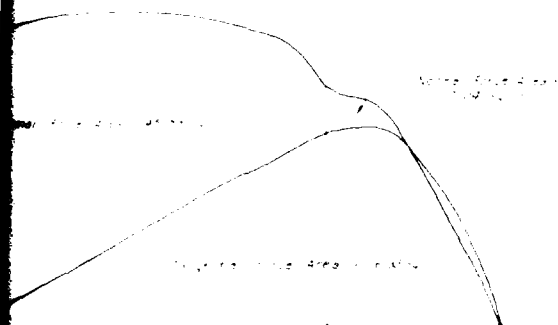
PLATE A25



7. WPA AND UNITED STATES DEPARTMENT OF COMMERCE



HIDDEN DRAWING, A PART OF THE CASE



TANGENTIAL FORCE, L. 4244

For surcharge
#5 - 144

For surcharge
#5 - 144

For surcharge
#5 - 144

ON DRAWING AREA ARE

Vertical Curve Data
Beginning Point
Station 100+00
End Point
Station 100+50
Length 500
Grade 1.00%
Grade 2.00%
Grade 3.00%
Grade 4.00%
Grade 5.00%
Grade 6.00%
Grade 7.00%
Grade 8.00%
Grade 9.00%
Grade 10.00%

NOMENCLATURE:

H Equivalent height of slide above failure surface
M Equivalent horizontal distance from failure surface
T Effective tangent distance from failure surface
L Length of arc of failure surface
Note: For adopted design values see plate 4244

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

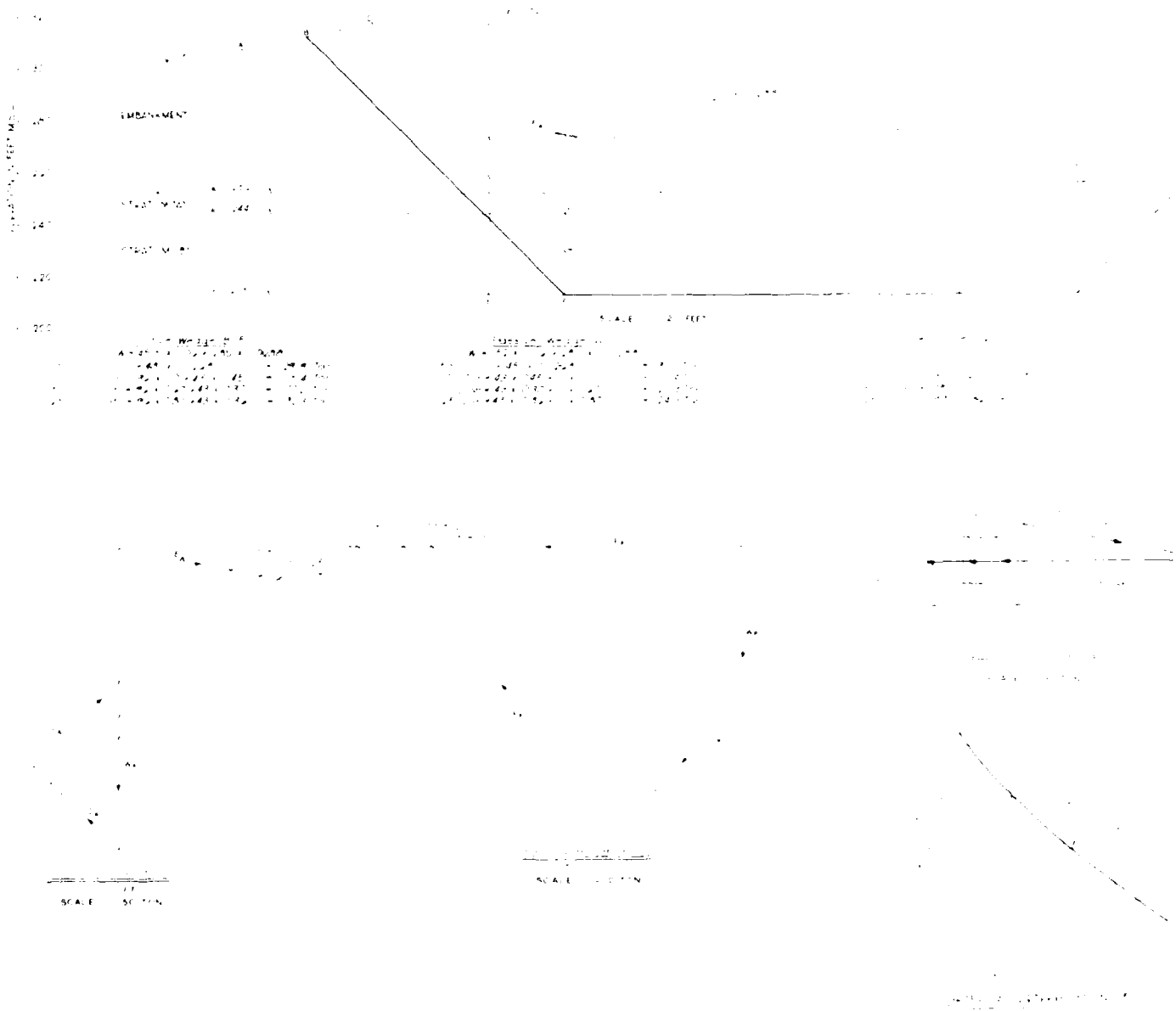
DATE	DESCRIPTION	MADE	CHECKED
	U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA		
	BRANCHED OAK DAM & RESERVOIR		
	STABILITY ANALYSES CIRCULAR ARC METHOD SUDDEN DRAWDOWN AND PARTIAL POOL CASES		
	DESIGNED BY CHECKED BY APPROVED BY DATE		
	DESIGNED BY CHECKED BY APPROVED BY DATE		
	DESIGNED BY CHECKED BY APPROVED BY DATE		

SCALE 1 INCH = 20 FEET
70 0 70



THIS PLAN ACCOMPANIES CONTRACT NO.
DA-38-066-00
MODIFICATION NO.

CORPS OF ENGINEERS



AD-A142 769

EMBANKMENT CRITERIA AND PERFORMANCE REPORT SALT CREEK
AND TRIBUTARIES NEBRASKA SITE 18 BRANCHED OAK DAM AND
LAKE(U) CORPS OF ENGINEERS OMAHA NE MAY 84

1/2

UNCLASSIFIED

F/G 13/13

NL

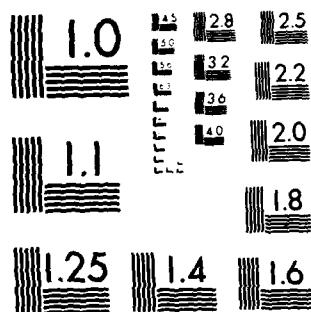
END

DATE

FILED

8-84

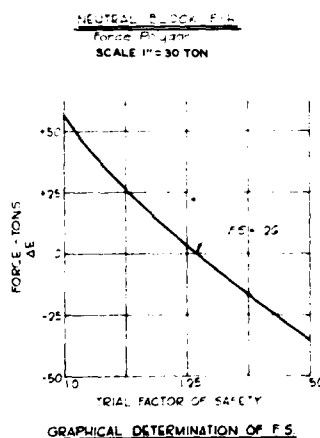
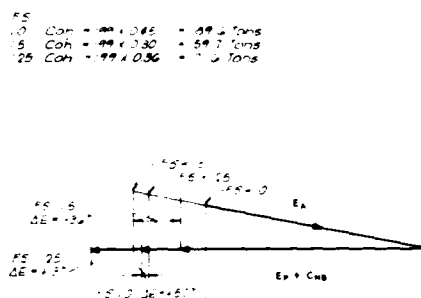
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SUMMARY OF STAB. DATA	
Slide Name	8 of 8
BF-L	12
BF-M	12
BFGK	12
AE-L	12
AE-M	12
AE-L	12
AE-M	12

- C - Cohesion per unit area
- C₀ - Cohesion developed per unit area
- Cohesion
- Assumed F.S.
- E_a - Resultant earth forces of active wedge
- E_{nb} - Resultant earth forces of neutral block
- E_p - Resultant earth forces of passive wedge
- ΔE - Difference between active and passive forces
- F.S. - Factor of Safety
- = Shear strength assumed
- = Shear strength developed at equilibrium
- W_a - Weight of active wedge
- W_p - Weight of passive wedge
- F_a OR F_p - Effective force on the slide plane and the direction in which it is acting.



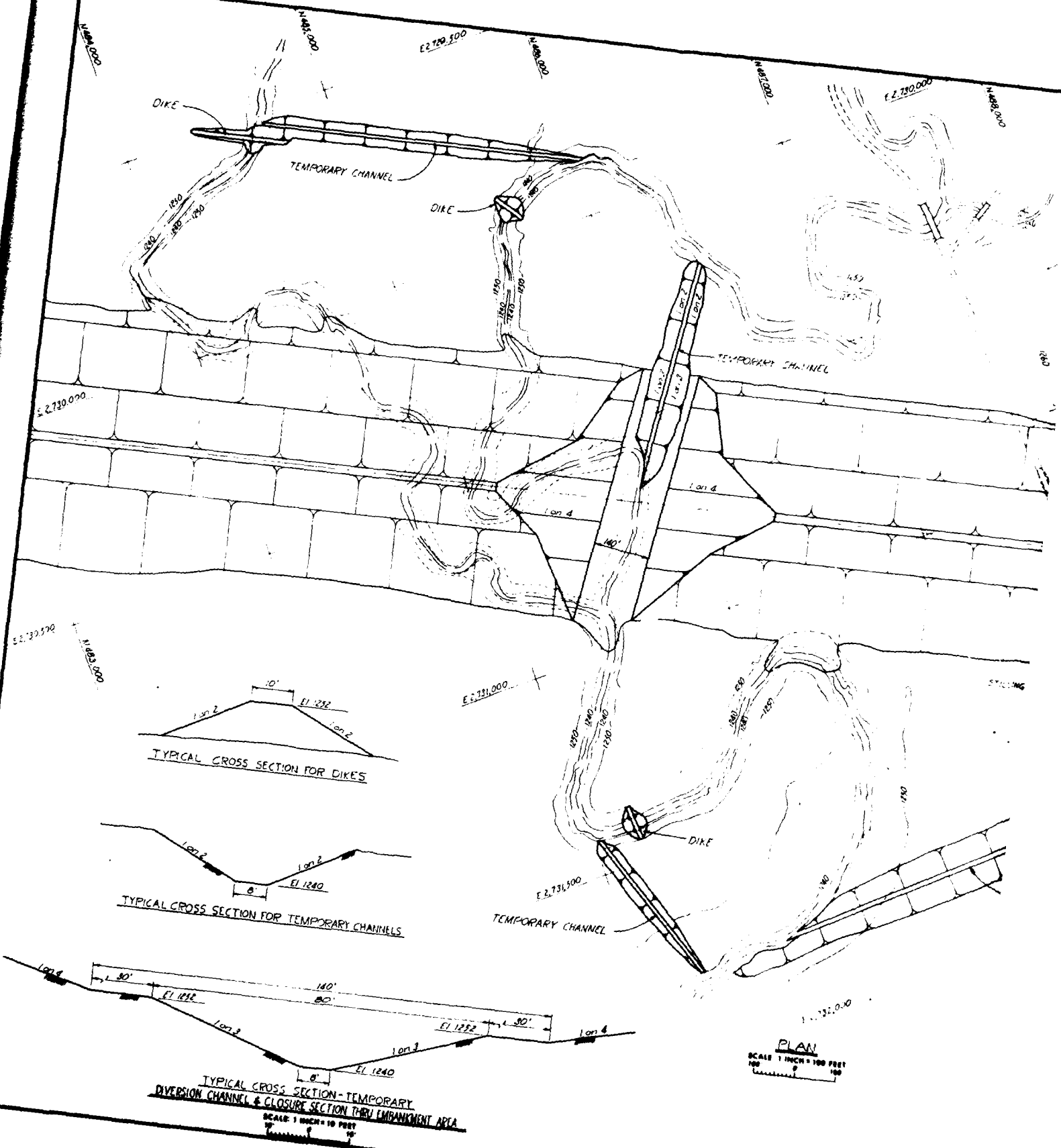
THIS DRAWING HAS BEEN REDUCED TO
ONE-EIGHTH THE ORIGINAL SCALE

DAYS	REGISTRATION NO.						GRADE	APPROVAL	
SE-18888									
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA									
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA Branched Oak Dam & Reservoir									
STABILITY ANALYSES WEDGE METHOD END OF CONSTRUCTION CASE									
DESIGNED BY E. O. N.									
CHECKED BY L. C. C.									
DESIGNED BY L. C. C.									
CHECKED BY C. W. H.									
BY <i>[Signature]</i>									
DATE <i>14 July 1968</i>	PROJECTED <i>Charles R. Ellogg</i>							DATE DEC 1968	
BY <i>[Signature]</i>									
DATE <i>14 July 1968</i>	CHECKED AS SHOWN							SPECIAL INQ.	
<i>Sheddy & Shaw</i>									

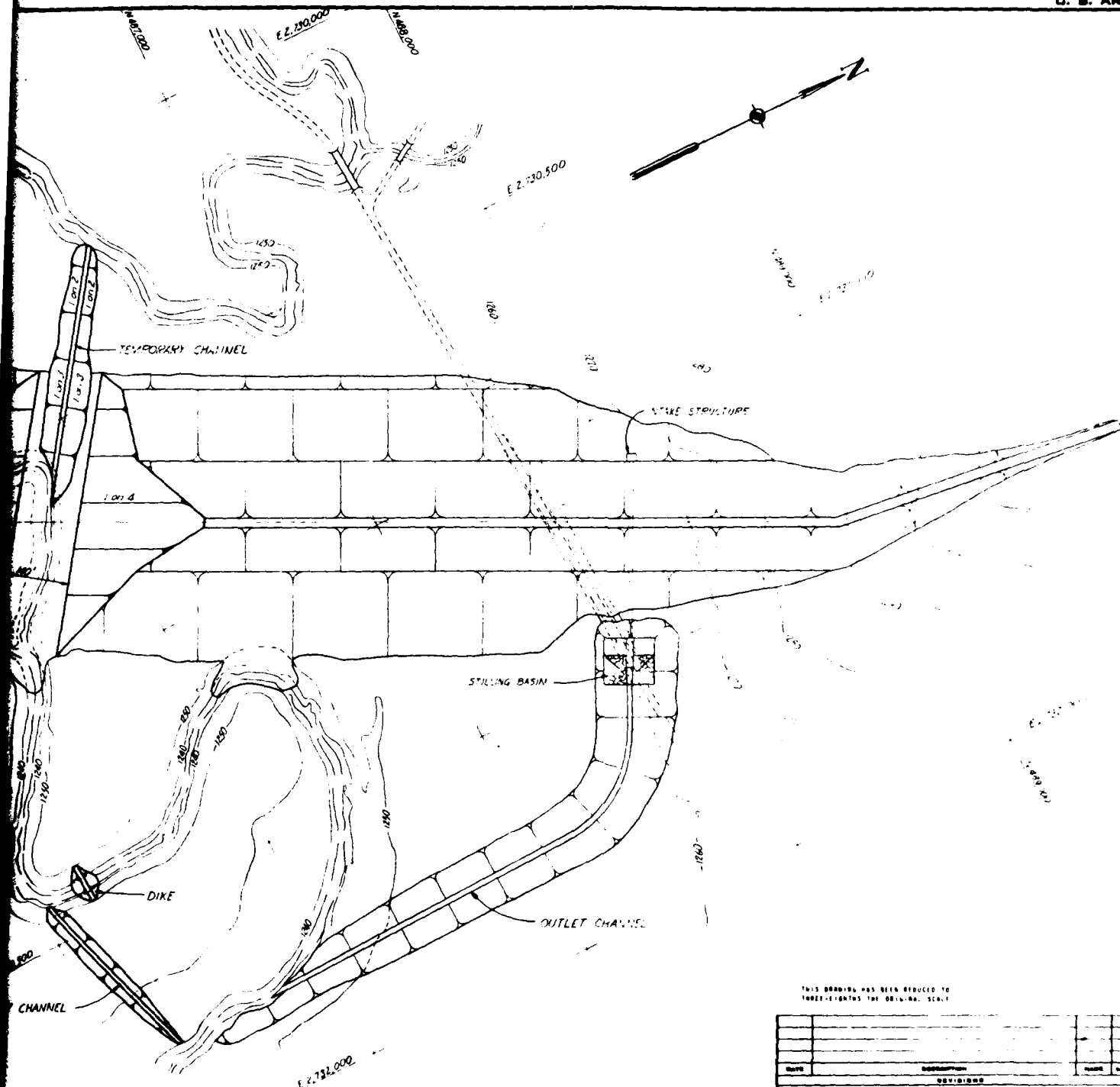


THIS PLAN ACCOMPANIES CONTRACT NO. 6A-22-222-
ADMINISTRATION IN

CORPS OF ENGINEERS



EMBANK



THIS DRAWING HAS BEEN REDUCED TO
THREE-EIGHTHS THE ORIGINAL SCALE

DATE		DESCRIPTION		PAGE		APPENDIX	
DIVISION							
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA							
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA							
BRANCHED OAK DAM & RESERVOIR							
DIVERSION AND CLOSURE							
PLAN AND SECTION							
DESIGNED BY	CH. R.	CHECKED BY	CH. R.	DATE	JUNE 1967		
DRAWN BY	CH. R.	DATE	JUNE 1967				
APPROVED BY				DATE			
THOMAS J. HARRIS				DATE			
THOMAS J. HARRIS				DATE			

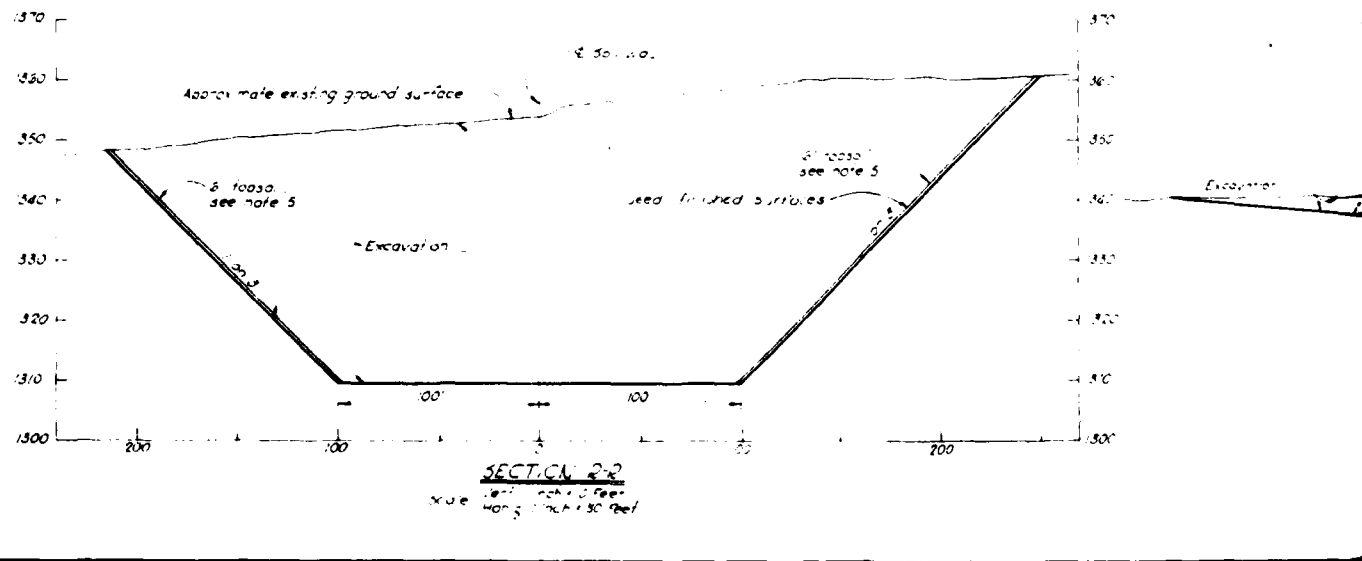
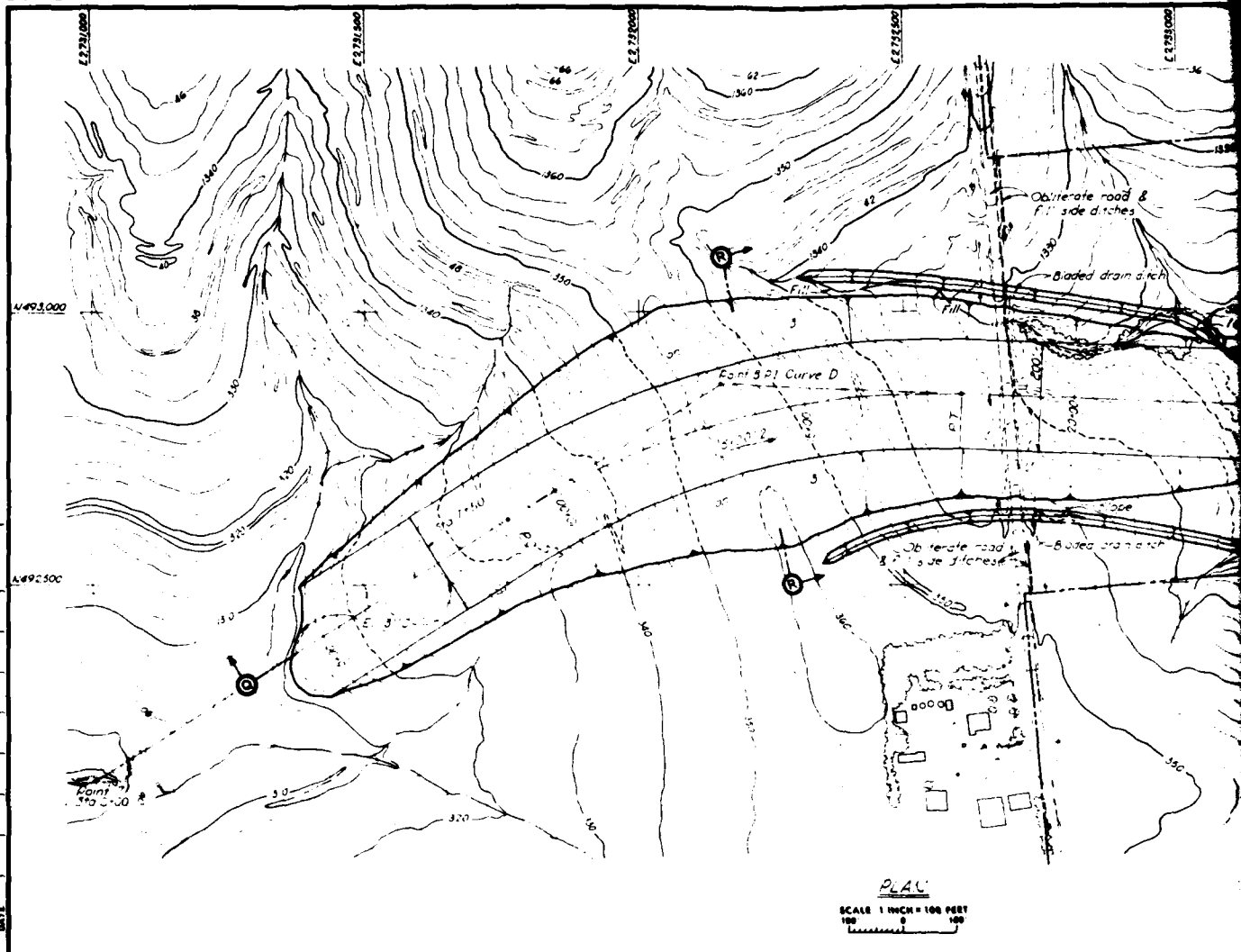


THIS PLAN ACCOMPANIES CERTIFICATE NO.
DA-20-000-100 MODIFICATION NO.

CORPS OF ENGINEERS

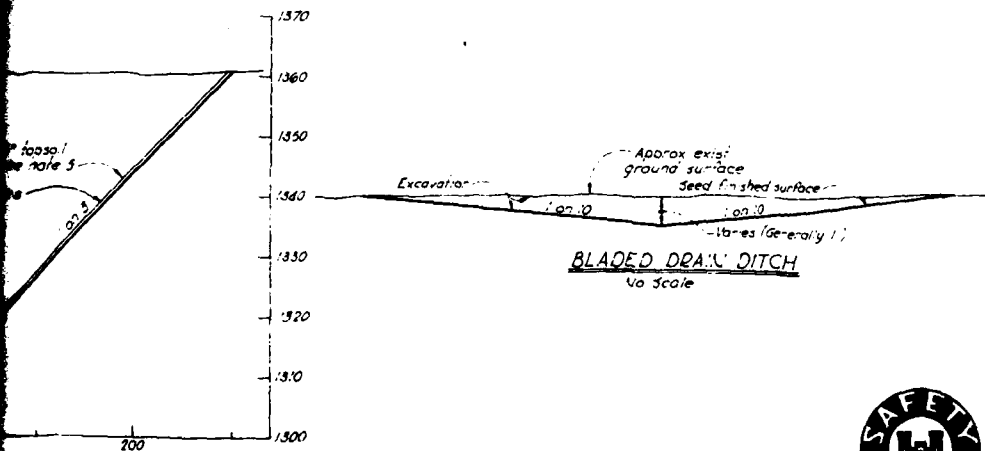
A 105 Measurement Plan or A Paper Reproducible Record
Copy Must Be Made Before Every Addition and/or Deletion

ADDITION NO.	DATE	MODIFICATION	DATE



PLAN

SCALE: 1 INCH = 100 FEET



1. Bladed drain ditches alignment and grade to be established in the field approximately one foot deep with on 10 side slopes. Construct small fills where necessary, adjacent to top of Spillway side slope to prevent drainage down Spillway Slope.
2. Where Spillway excavation cuts natural Terraces, provide necessary earthwork to prevent drainage down Spillway side slope.
3. All Elevations shown refer to feet above M.S.L., 1954 General Adjustment.
4. For Control Points, see PLATE A2.
5. Place 6" layer of topsoil on excavated 1 on 3 slopes of Spillway from bottom of Spillway to the top of the slope.

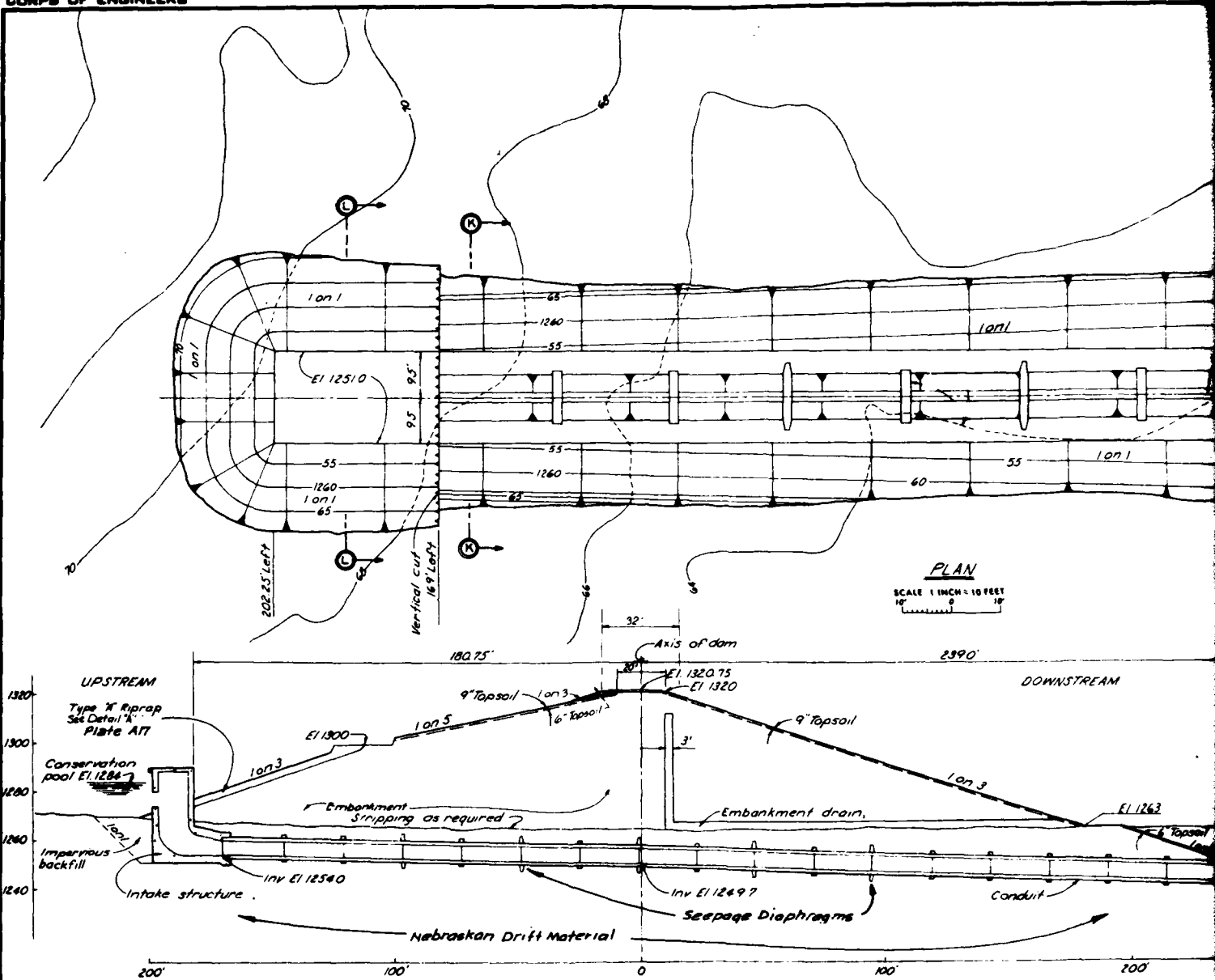
DATE	DESCRIPTION	MADE	APPROVED
DESIGNS			
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
DESIGNED BY T A S CHECKED BY A G D DRAWN BY GRADING BY L J S	BALLY CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM AND LAKE SITE NO. 18 SPILLWAY GRADING PLAN AND SECTION		
22 JUL 1968 11:00 AM 11:00 AM	APPROVED <i>John E. H. H.</i>		DATE JULY 1968 MADE BY SPEC. NO.
11:00 AM 11:00 AM 11:00 AM	11:00 AM 11:00 AM 11:00 AM		11:00 AM 11:00 AM 11:00 AM



THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO

2

CORPS OF ENGINEERS



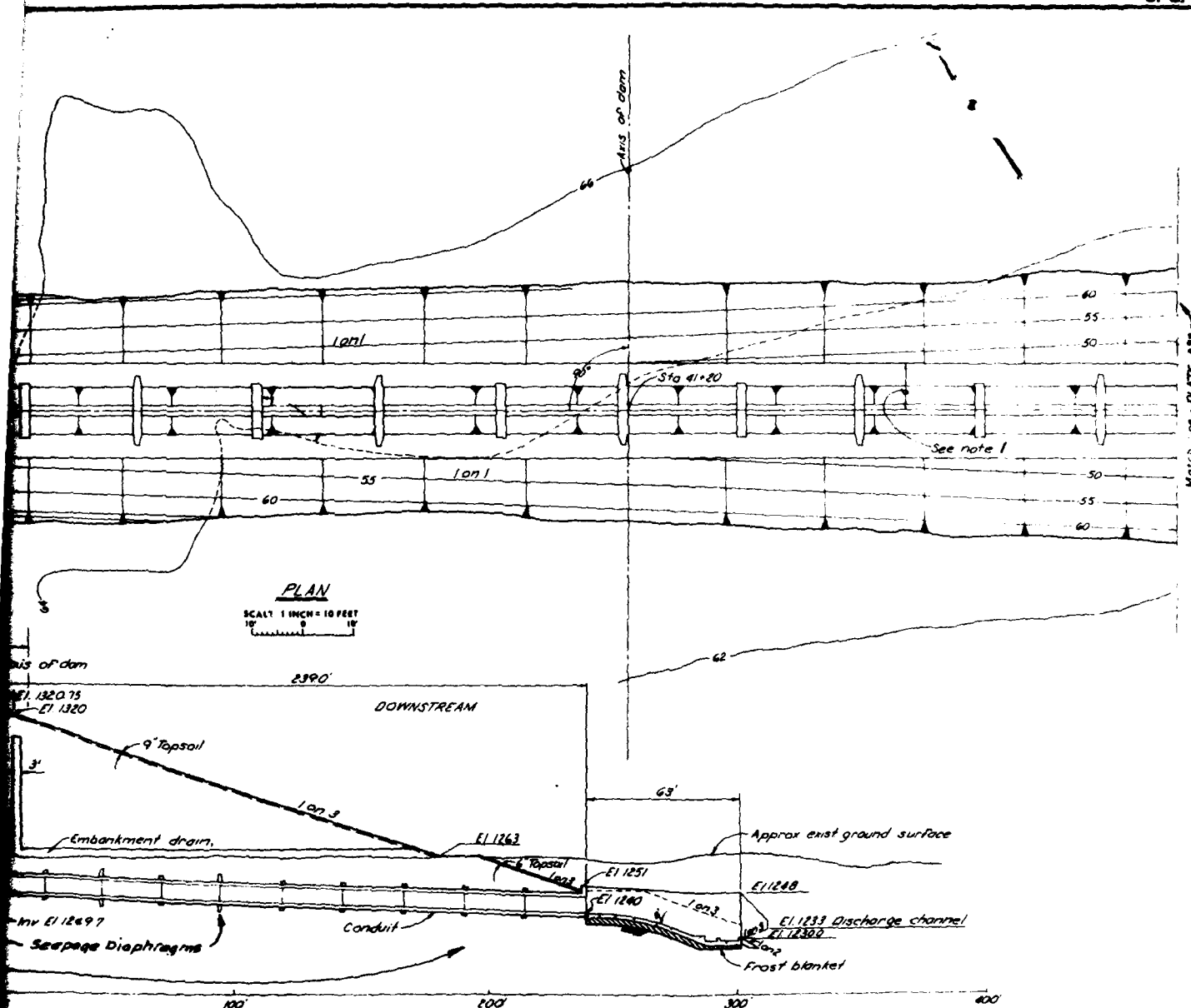
LONGITUDINAL SECTION THRU OUTLET WORKS

SCALE 1 INCH = 20 FEET

GENERAL NOTES:

1. 9.5' from L conduit to slope at 0.5' above invert
2. For location of section
3. All elevations shown re M.S.L., 1954 General Adj.

EMBANKMENT



THRU OUTLET WORKS

GENERAL NOTES:

1. 9.5' from E. conduit to control for 1 on 1 slope at 0.5' above invert elevation.
2. For location of sections, see PLATE A33.
3. All elevations shown refer to feet above M.S.L., 1984 General Adjustment.



U. S. ARMY ENGINEER DISTRICT, CHAMPAIGN BRANCH OF ENGINEERING CHAMPAIGN, ILLINOIS	
SALT CREEK AND ITS TRIBUTARIES, ILLINOIS BRANCHED OAK DAM AND LAKE SITE NO. 18 OUTLET WORKS EXCAVATION PLAN - SHEET 1	
DESIGNED BY R.J.M. CHECKED BY R.F.M. DRAWN BY R.F.M. SCALE 1/4" = 1'-0"	DATE 1/1/83 BY [Signature] FOR [Signature]
DATE 1/1/83 BY [Signature] FOR [Signature]	DATE 1/1/83 BY [Signature] FOR [Signature]
MSC13-310E7	

1266

1264

1262

1260

1258

1256

EL 1238.5

EL 1236.0

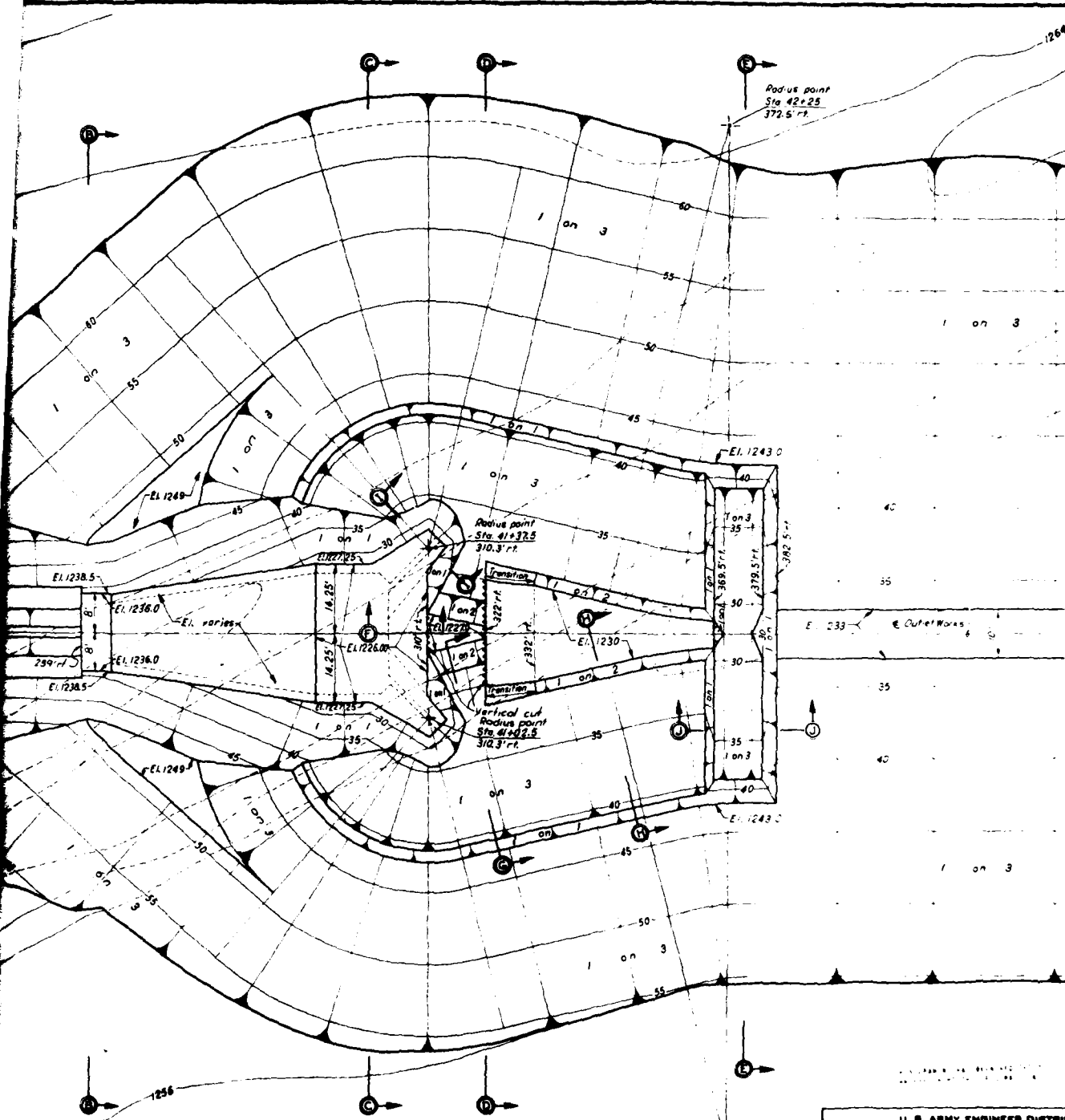
EL 1249

EL 1226.0

PLAN

GENERAL NOTES:

1. All elevations above 1000 ft. to foot of
M.S.B., 1954 Standard Supplement.



PLAN
SCALE 1 INCH = 10 FEET

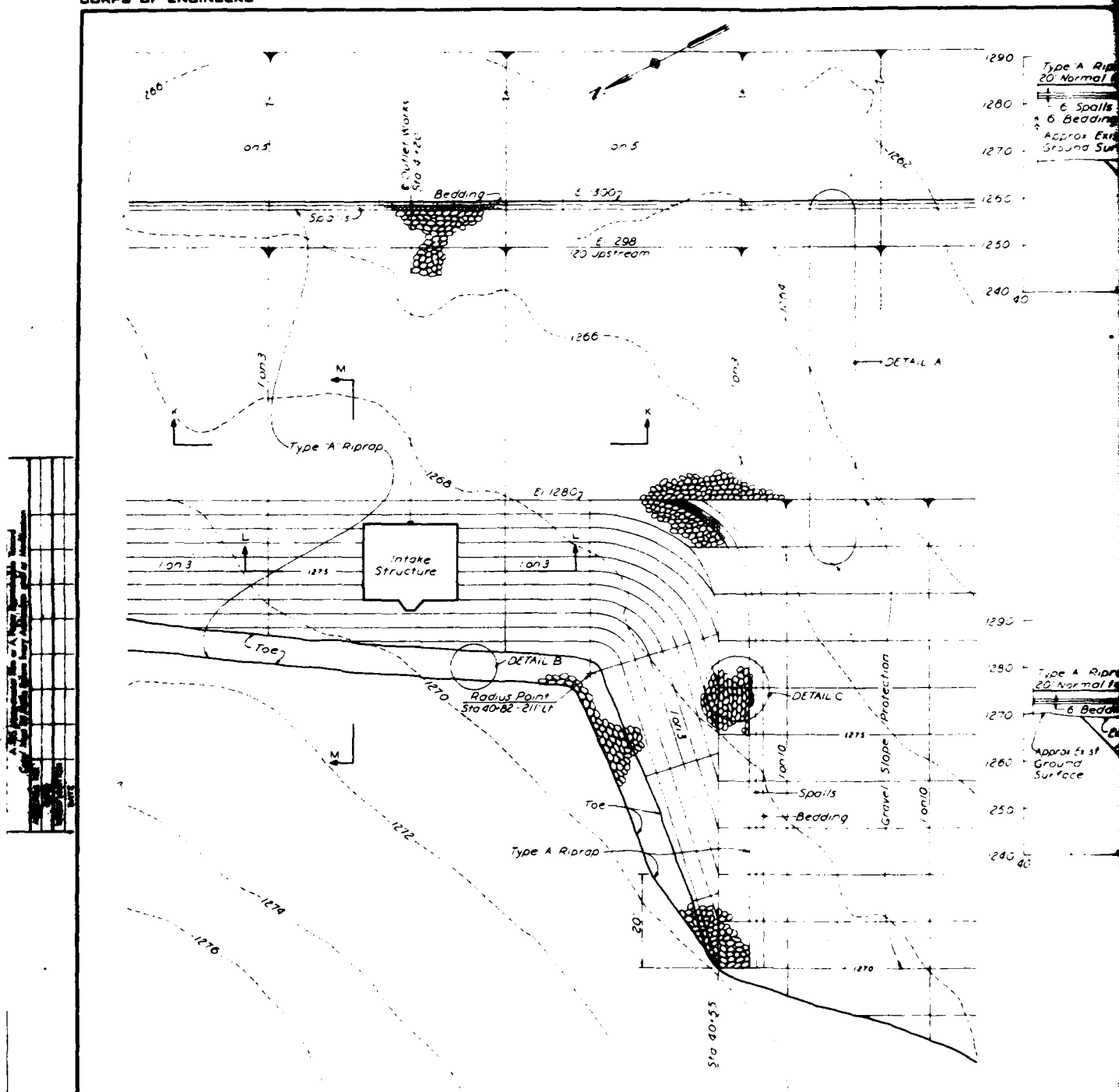
GENERAL NOTES:

1. All elevations shown are in feet above M.S.L., 1984 National Mean Sea Level.



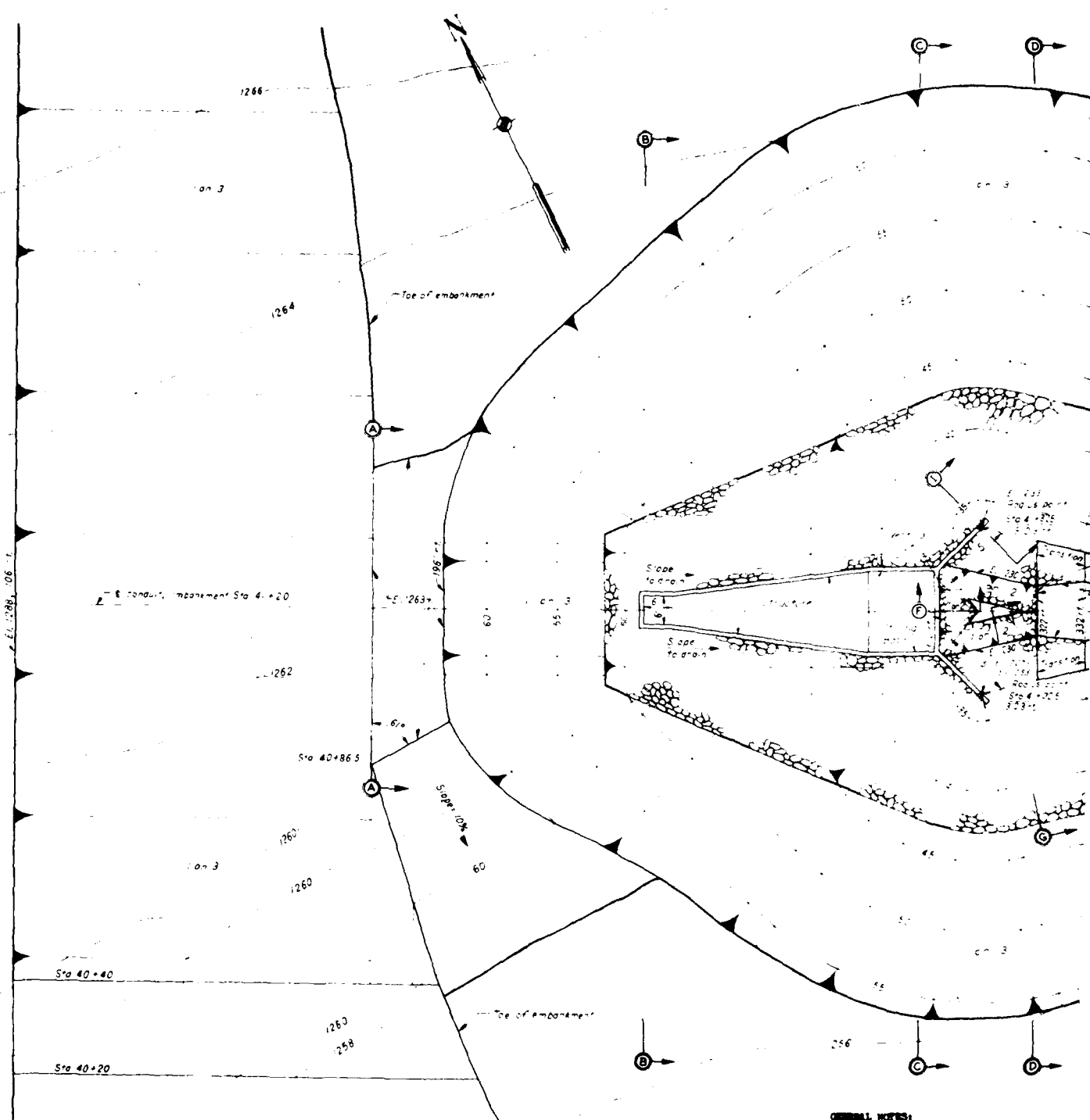
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SAND CREEK AND Y-15 BRIDGES REBRIDGE BRANCHED OAK DAM AND LAKE SITE NO. 18 OUTLET WORKS EXCAVATION PLAN-SHEET 2			
DESIGNED BY <i>W. J. H. H.</i>	CHECKED BY <i>Charles E. Hopp</i>	DATE FEB 1980	DRAWN BY <i>Sheld'n L. Clew</i>
APPROVED BY <i>Sheld'n L. Clew</i>	DATE IN CHARGE FEB 1980	DATE OF REV. FEB 1980	
PROJECT NUMBER MSC13-310EB			

CORPS OF ENGINEERS



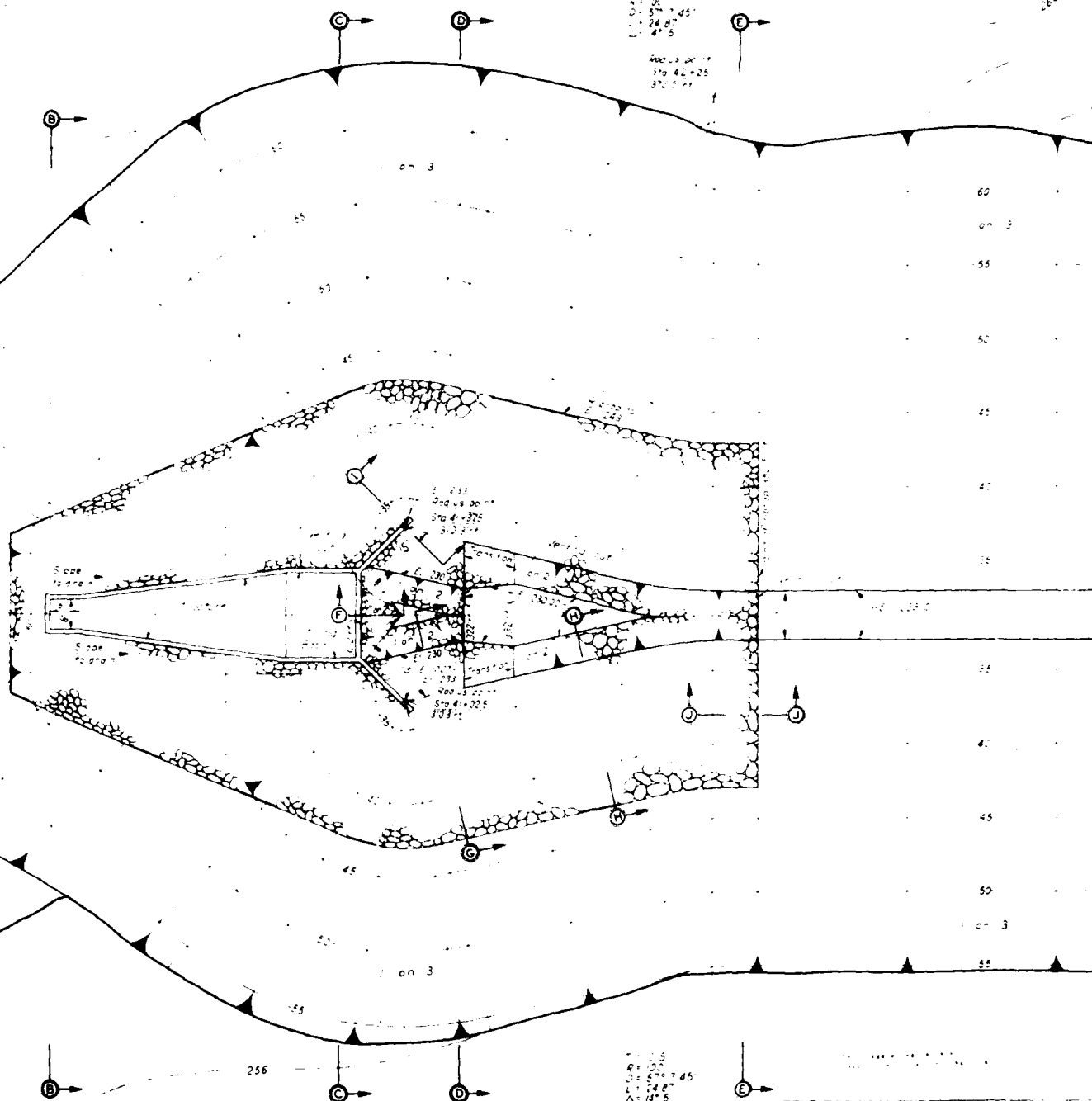
OUTLET WORKS EMBANKMENT PLAN

CORPS OF ENGINEERS



- GENERAL NOTES:**
1. All Elevations shown refer to Feet at 1954 General Adjustment.
 2. For location of Sections, see PLATE
 3. All distances shown as St., are mean Axis of Dam.

EMBANKME



GENERAL NOTES:

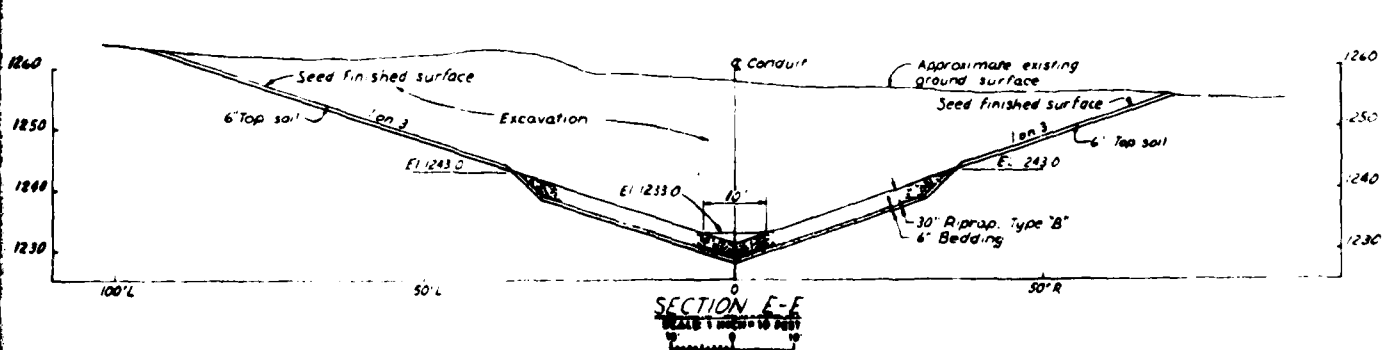
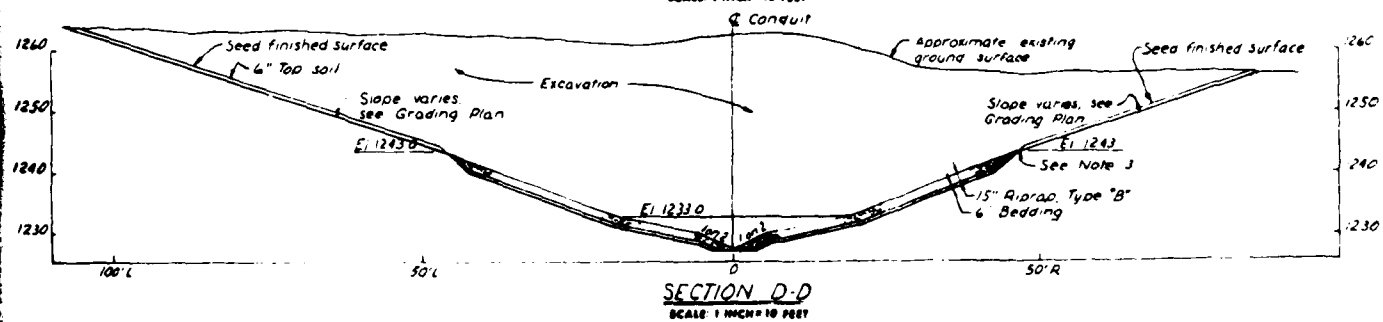
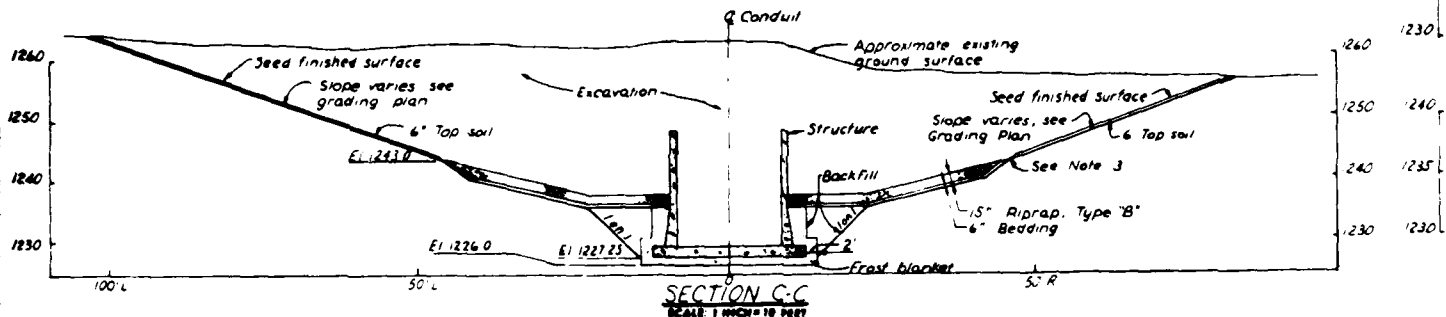
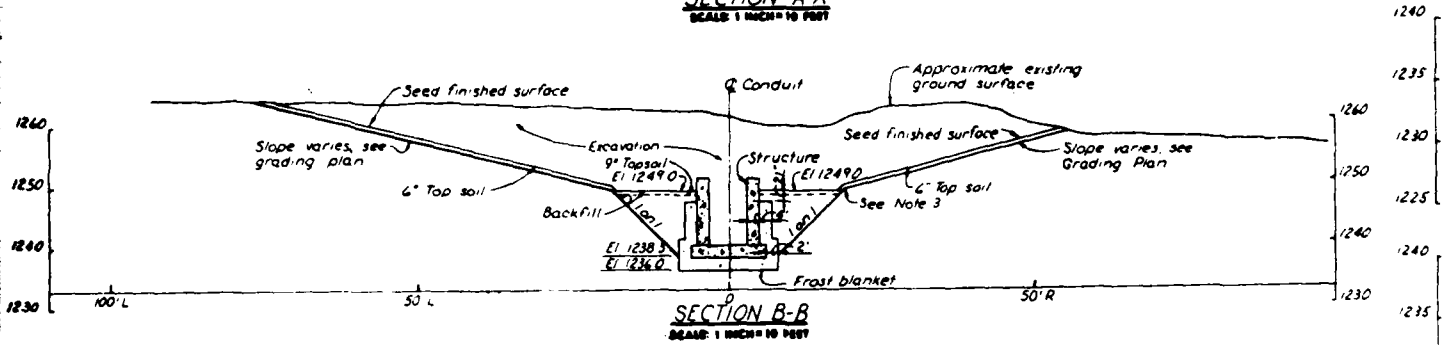
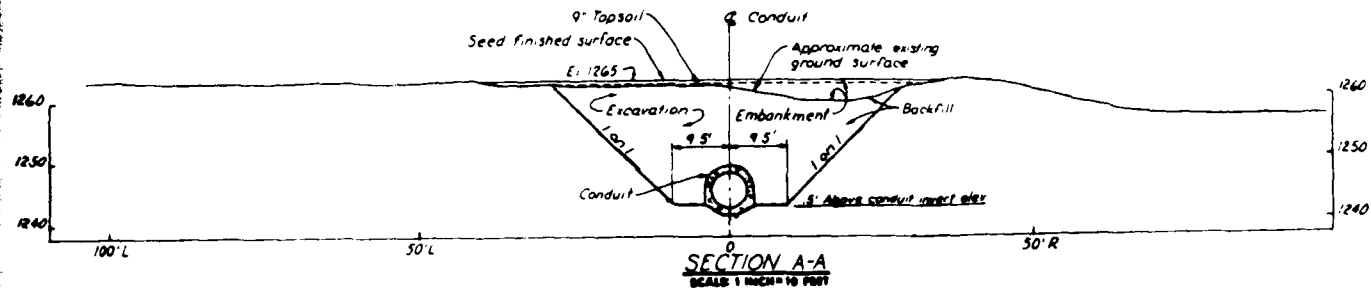
1. All Elevations shown refer to Feet above M.S.L., 1954 General Adjustment.
2. For location of Sections, see PLATE A35.
3. All distances shown as R.L. are measured from Axis of Dam.

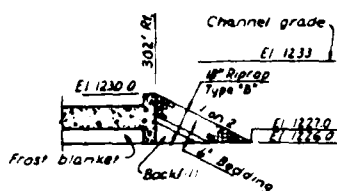
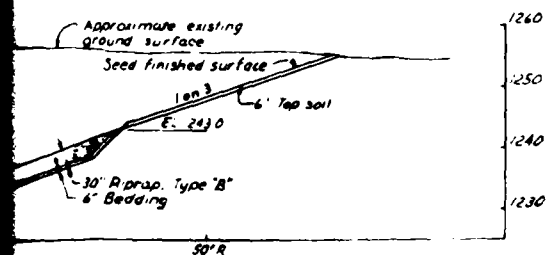
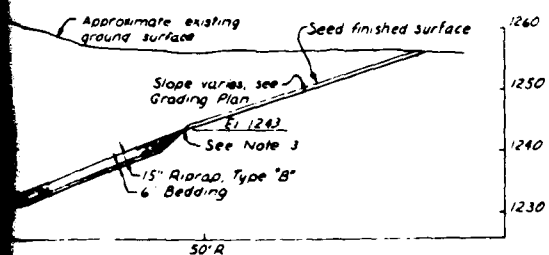
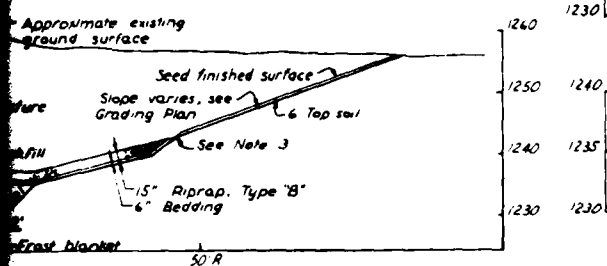
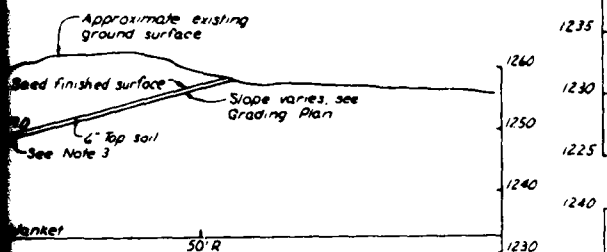
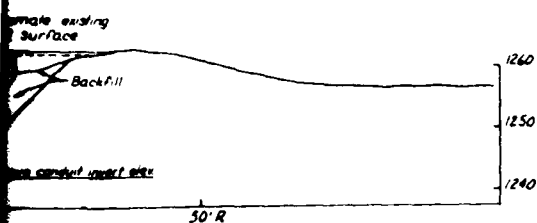
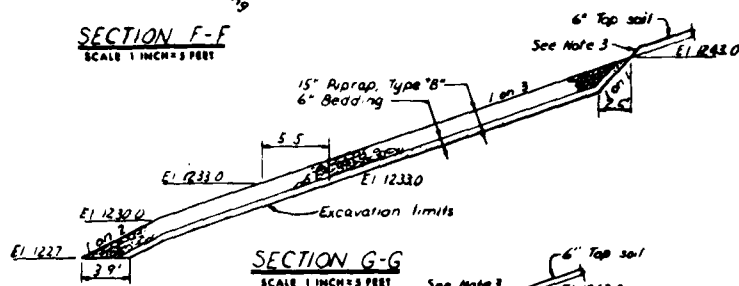
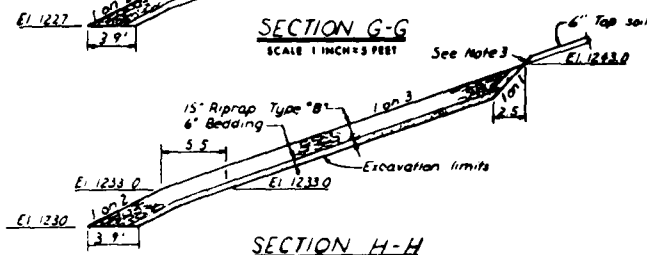
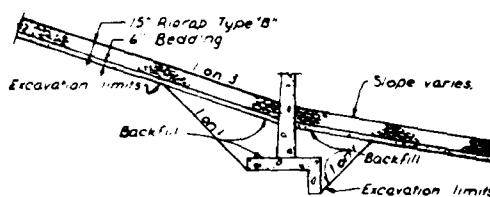
PLAN

SCALE 1 INCH = 10 FEET



U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
BRANCHED OAK DAM AND LAKE SITE NO. 18 OUTLET WORKS EMBANKMENT PLAN-SHEET 2	
DESIGNED BY: <i>[Signature]</i>	APPROVED: <i>[Signature]</i>
DRAWN BY: <i>[Signature]</i>	DATE: FEB 1983
CHECKED BY: <i>[Signature]</i>	PROJECT NO: MSC13-310E10
APPROVED: <i>[Signature]</i>	



SECTION F-F
SCALE 1 INCH = 5 FEETSECTION G-G
SCALE 1 INCH = 5 FEETSECTION H-H
SCALE 1 INCH = 5 FEETSECTION I-I
SCALE 1 INCH = 5 FEETSECTION J-J
SCALE 1 INCH = 5 FEET

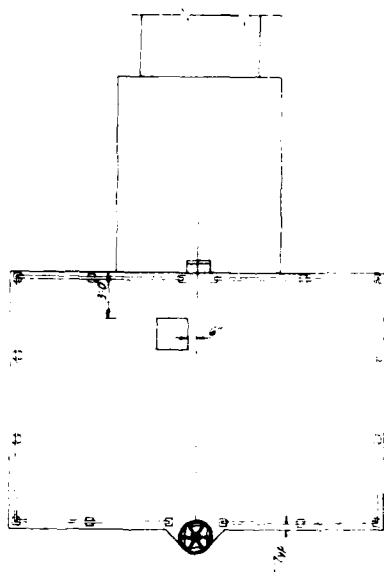
GENERAL NOTES:

1. All elevations shown refer to feet above M.S.L., 1954 General Adjustment.
2. For location of sections, See Plates A32 & A34.
3. Controls for grading are for excavated slopes, topsoil shall be placed over excavated slopes and transitioned as indicated at contact between fill and excavation.

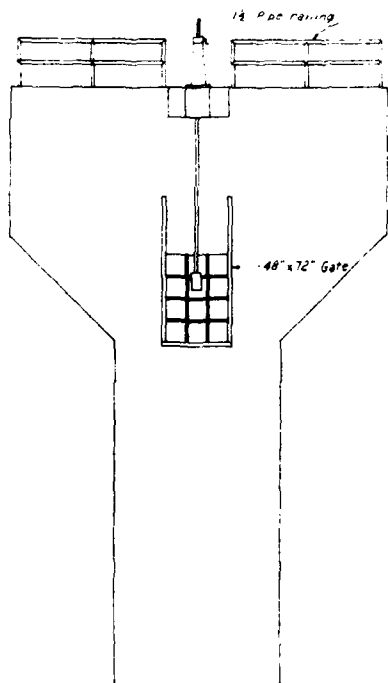


U. S. ARMY ENGINEER DISTRICT, OKLAHOMA	
GROUP OF DISTRICTS	
OKLAHOMA, KENTUCKY	
WALT CREEK AND ITS TRIBUTARIES, KENTUCKY	
BRANCHED OAK DAM & RESERVOIR	
OUTLET WORKS	
SECTIONS	
DESIGNED BY: R. J. M.	DATE: FEB. 1970
DRAWN BY: J. L. C.	DATE: FEB. 1970
CHECKED BY: J. L. C.	DATE: FEB. 1970
APPROVED BY: [Signature]	DATE: FEB. 1970
MSCD-30211	

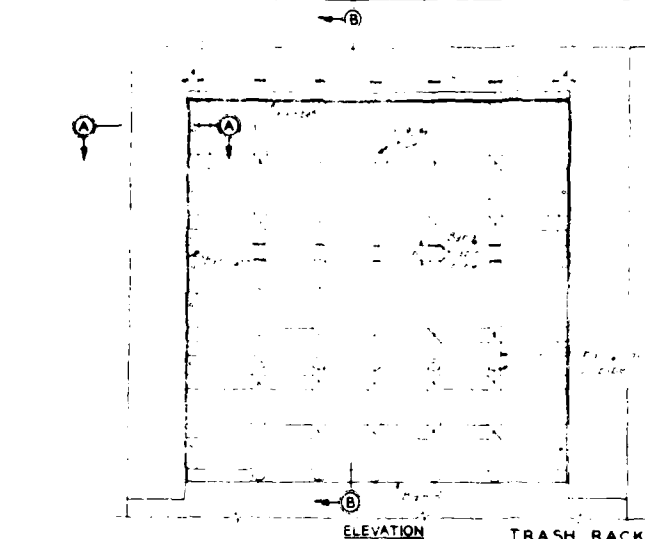
CORPS OF ENGINEERS



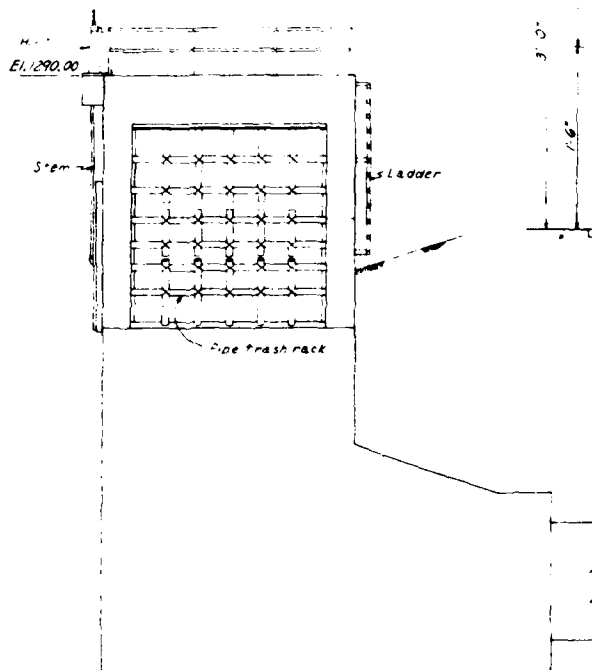
PLAN



FRONT ELEVATION



ELEVATION



SIDE ELEVATION

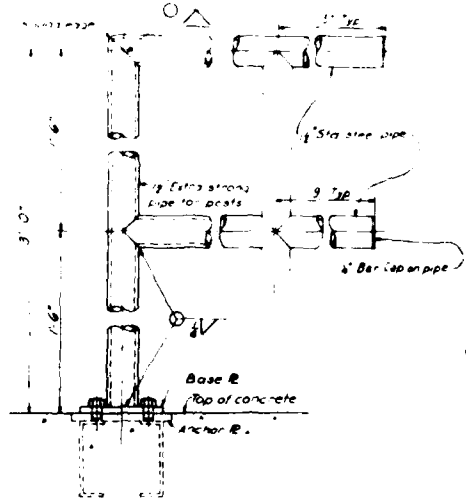
INTAKE STRUCTURE

SCALE: 1/4" = 1' 0"



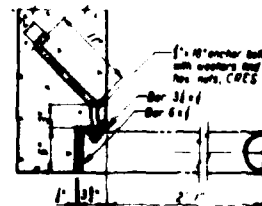
TRASH RACK DETAILS

SCALE: 1/4" = 1' 0"



ELEVATION

TYPICAL STEEL PIPE GUARD

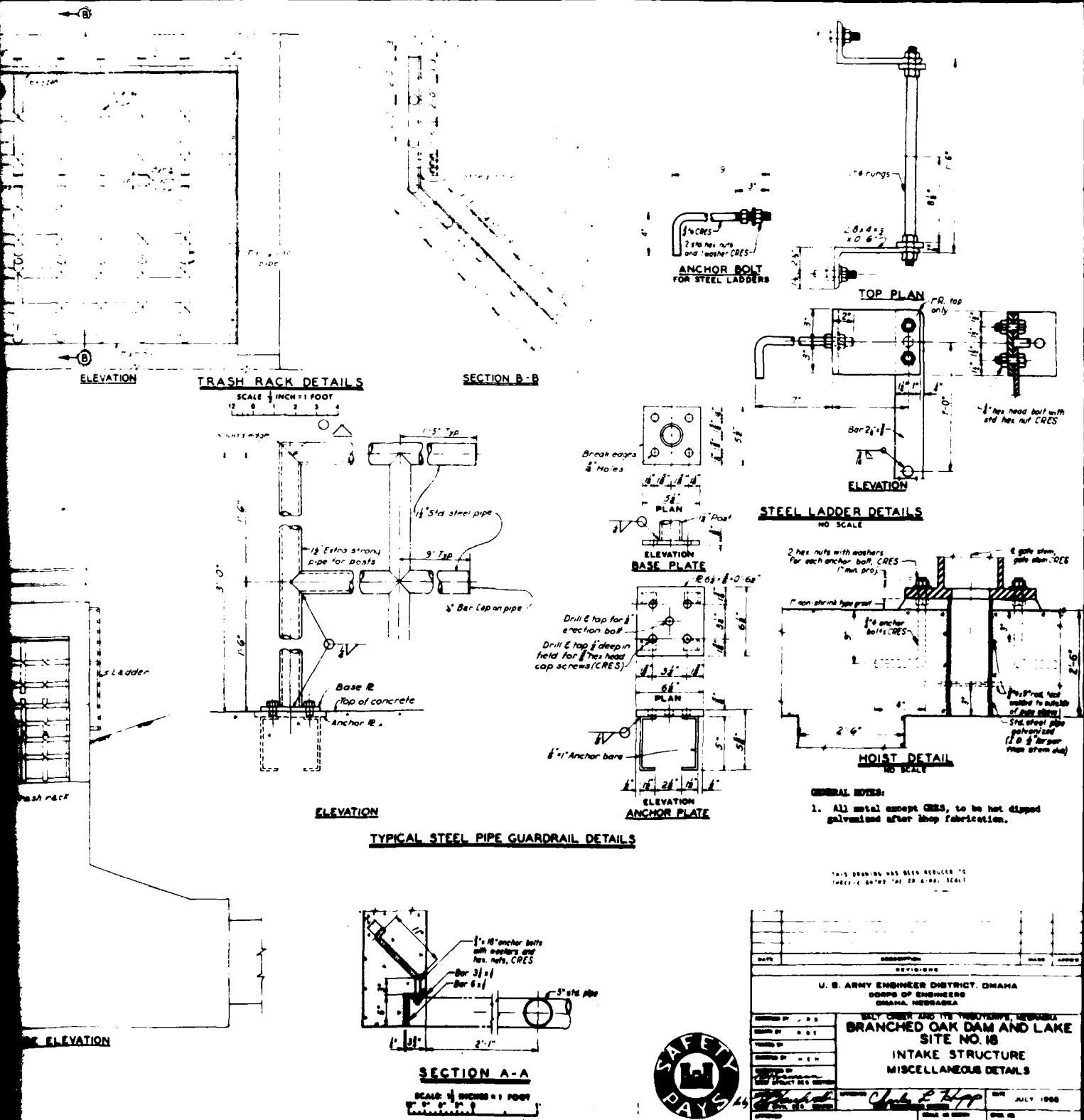


SECTION A-A

SCALE: 1/4" = 1' 0"



EMBANKMENT

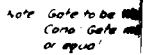


DATE	DESCRIPTION	REVISION	DATE	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA				
BAILY CREEK AND THE TUGBOYNE, NEBRASKA BRANCHED OAK DAM AND LAKE SITE NO. 18 INTAKE STRUCTURE MISCELLANEOUS DETAILS				
DESIGNED BY	CHIEF ENGINEER	DATE	JULY 1968	
DRAWN BY	ENGINEER	DATE	JULY 1968	
CHECKED BY	ENGINEER	DATE	JULY 1968	
APPROVED BY	ENGINEER	DATE	JULY 1968	
THIS PLAN ACCOMPANIES CONTRACT NO. 100-100-100-100				

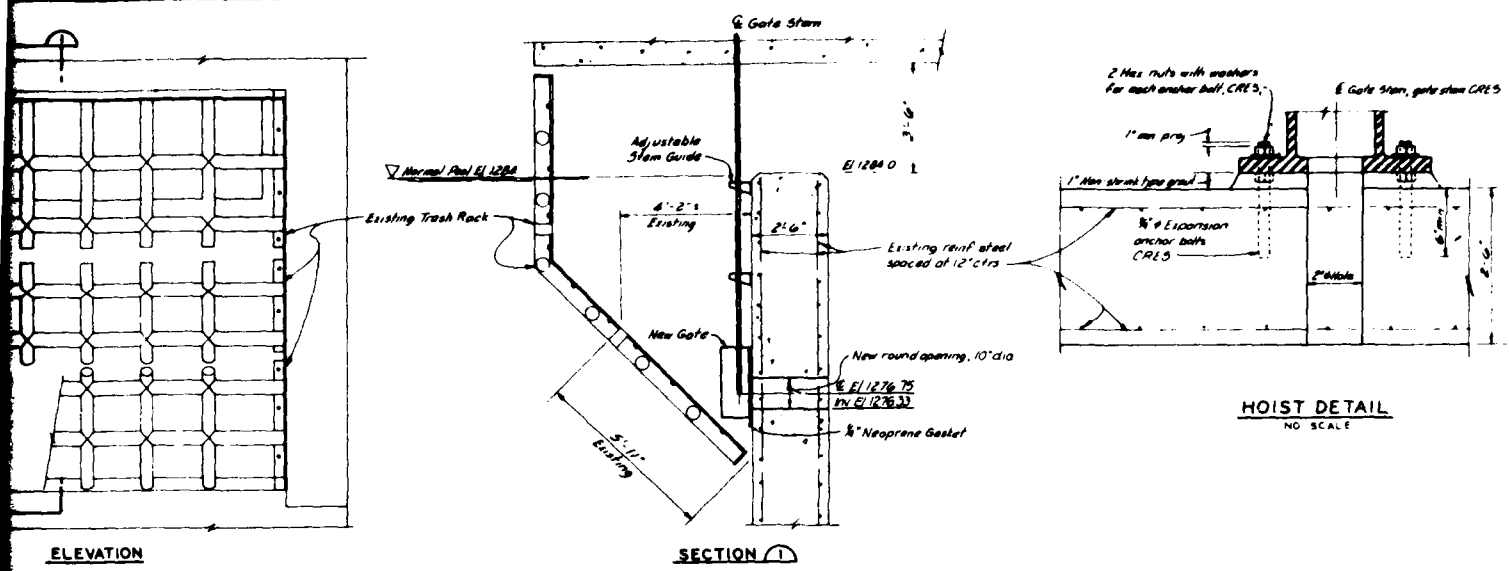
25



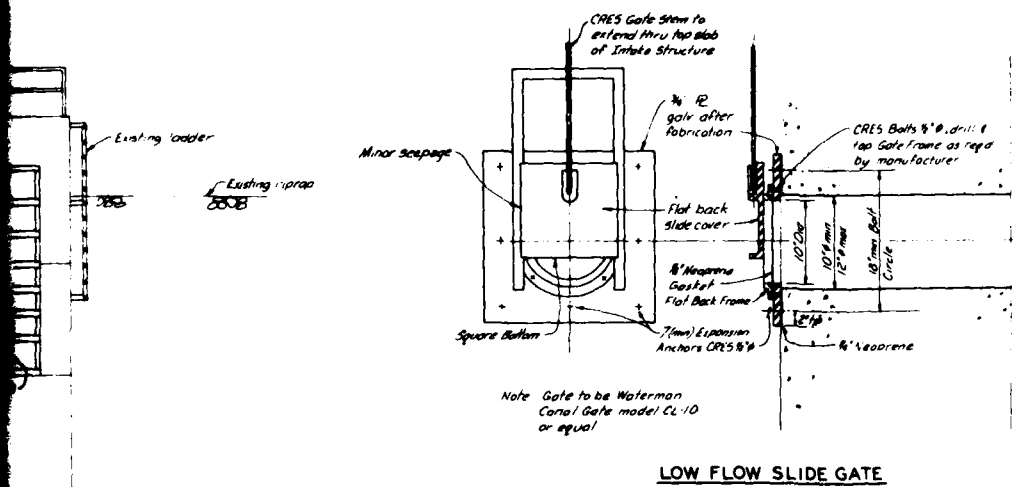
SCALE $\frac{1}{2}$ INCH = 1 FOOT



SCALE $\frac{1}{2}$ INCH = 1 FOOT



NEW GATE DETAIL
SCALE 1/4" INCH = 1 FOOT
12 0 1 2 3 4



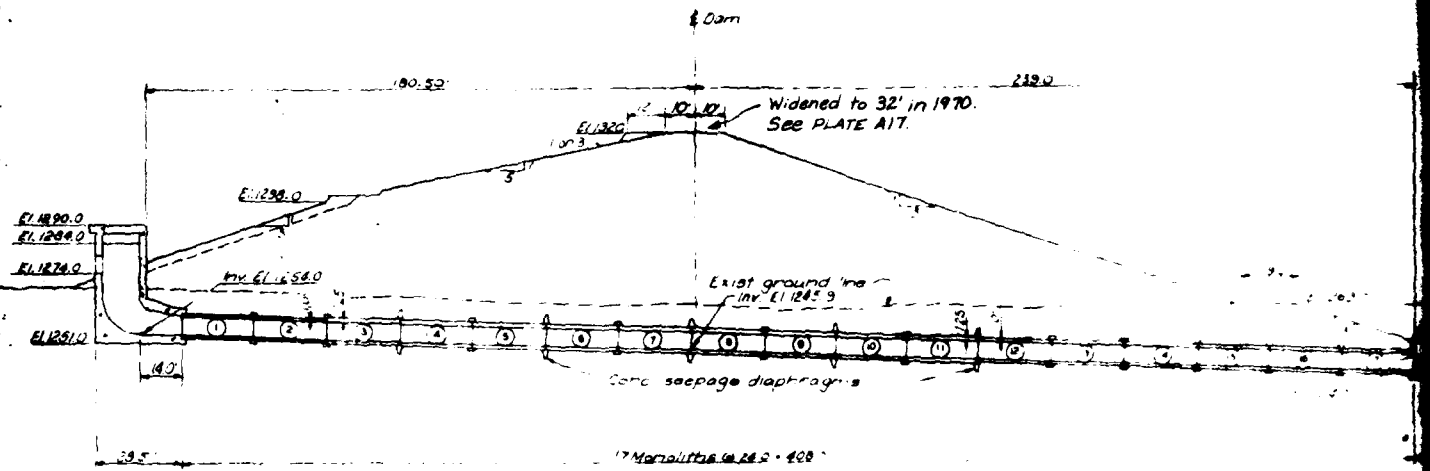
LOW FLOW SLIDE GATE

- Notes
1. Contractor shall verify that existing trash rack can be replaced if removed and does not interfere with new gate
 2. CRES - Corrosion Resisting Steel

THIS DRAWING HAS BEEN REDUCED TO
THREE EIGHTHS THE ORIGINAL SCALE

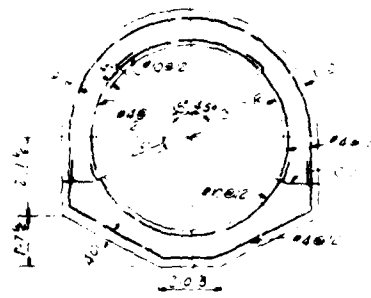
U. S. ARMY ENGINEER DISTRICT, OMAHA BUREAU OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK AND ITS TRIBUTARIES, NEBRASKA BRANCHED OAK DAM AND LAKE SITE NO. 16 WATER RIGHTS GATE DETAILS			
DESIGNED BY C. A. Stolt	CHECKED BY R. B. Bunch	DATE MAY 1983	DRAWN BY J. S. H. J.
SCALE 1/4" = 1'-0"	DATE MAY 1983	DATE MAY 1983	
PROJECT NO. MSC30-61E2			PLATE A37

OF ENGINEERS

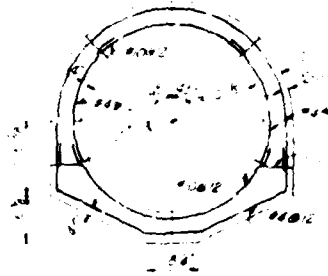


SECTION THRU STRUCTURE

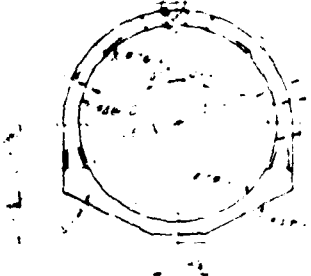
SCALE 1"=100'-0"



MONOLITHS 3 THRU 11



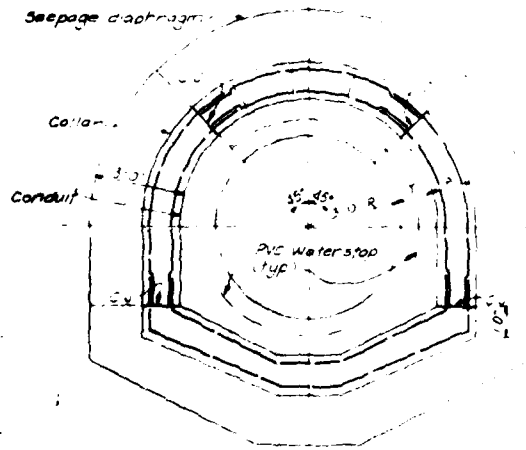
MONOLITHS 12, 13 & 14



MONOLITHS 15 THRU 17

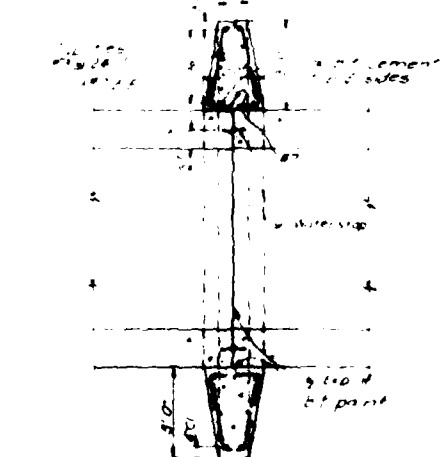
SECTIONS THRU CONDUIT

SCALE 1"=100'-0"



SECTION

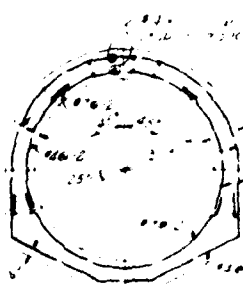
SHOWING COLLAR & REINFORCED
WATERSTOP AND SEEPAGE
DIAPHRAGM L.M.T.S.
SCALE 1"=100'-0"



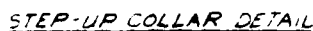
MONOLITH JOINT AND
CONCRETE SEEPAGE DIAPHRAGM
DETAIL
SCALE 1"=100'-0"

MONOLITH JOINT &
COLLAR DETAIL

SCALE 1"=100'-0"



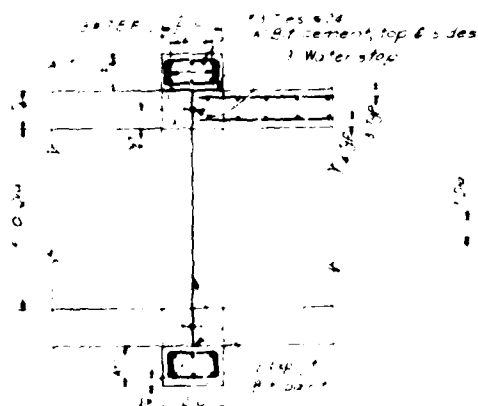
MONOLITHS 14 THRU 17



ISALF & MENALEDOT

GENERAL NOTES:

1. Clear distance of reinforcement from exposed surfaces shall be 4".
2. Reinforcement is not continuous through column-lift joints.



MONOLITH JOINT &
COLLAR DETAIL

RECEIVED 1993



SCALE 2 INCHES = 1 FOOT

[illegible]

205' x 4" Ø PERFORATED
PVC (SCHEDULE 40)
DRAIN PIPE

P2 - 20

15' X 4" Ø PLAIN PVC
S. 485 80, DRAIN PIPE

EXISTING GABLE

3' TC : 148 24405 1.

PLATE CUT

4" DIAPHRAGM
HYDROLYSIS
DRAIN PIPE SEE
EFFECT A

SECTION A-A
1/4" = 1' E

STILLING BASIN PLAN

SALT CREEK DAN SITE 18
SCALE: 1" = 40'-0"

NOTE

THIS SECTION
IS TYPICAL TO
SECTION A-A
EXCEPT AS NOTED.

6' DEEP TRENCH
AT THIS SECTION

CUT 44: 1250 C

COARSE SAND

IMPERVIOUS BACKFILL
(NO SAND IN THIS TRENCH)

101 PAGE

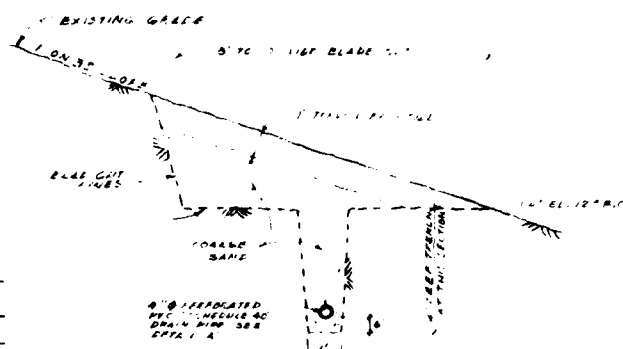
5" x 4" 0 PLAIN (UNPERF) PVC
(SCHEDULE 40) DRAIN PIPE

LOT OF TRENCU

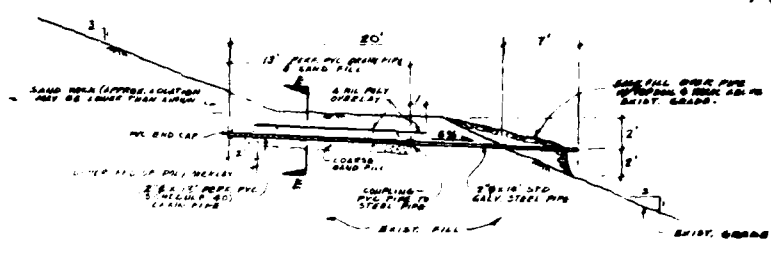
JACKSON LPR 11 OF FIRE WITH
TOPSOIL & ROCK AS SHOWN

SECTION C-C
(DEVELOPED SECTION)
14" x 20' 0"

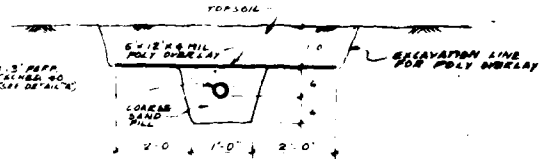
PVC
PIPE



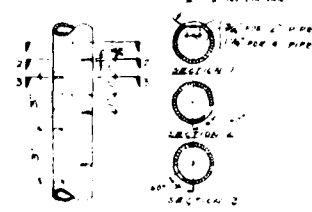
SECTION A-A
1/2" = 1' 0"



SECTION D-D
NO SCALE

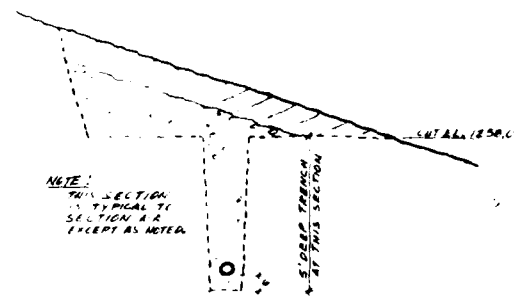


SECTION E-E
NO SCALE



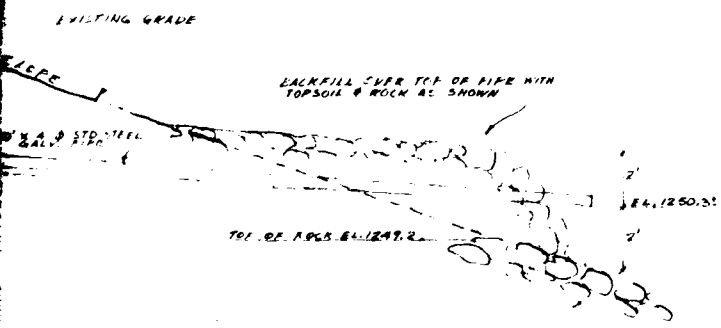
DETAIL A
NO SCALE
SLOT ARRANGEMENT FOR PERFORATED PIPE

STILLING BASIN PLAN
DAM SITE IS
1" = 20' 0"



SECTION B-B
1" = 20' 0"

NOTE:
THIS SECTION
IS TYPICAL TO
SECTION A-A
EXCEPT AS NOTED.

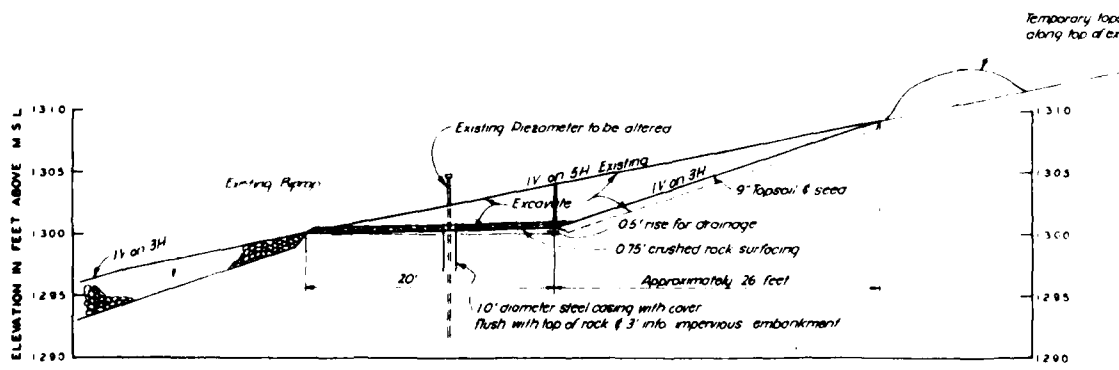
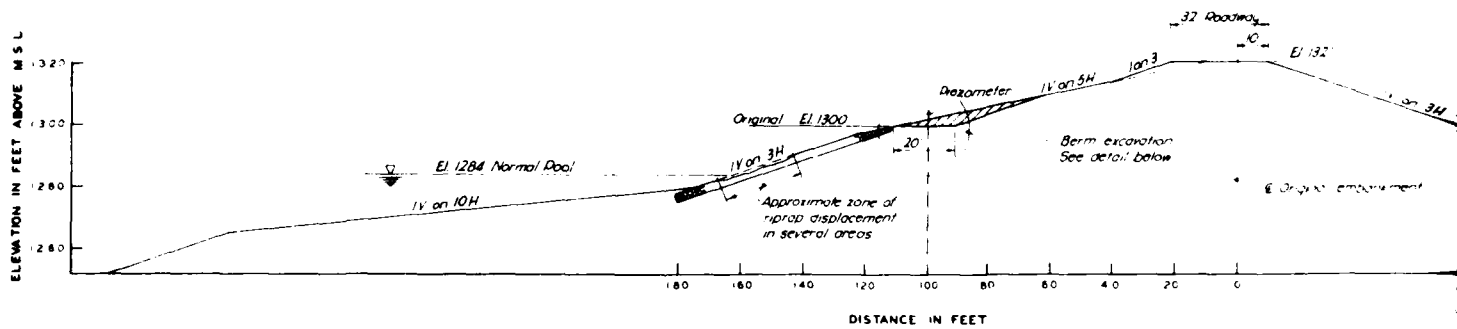
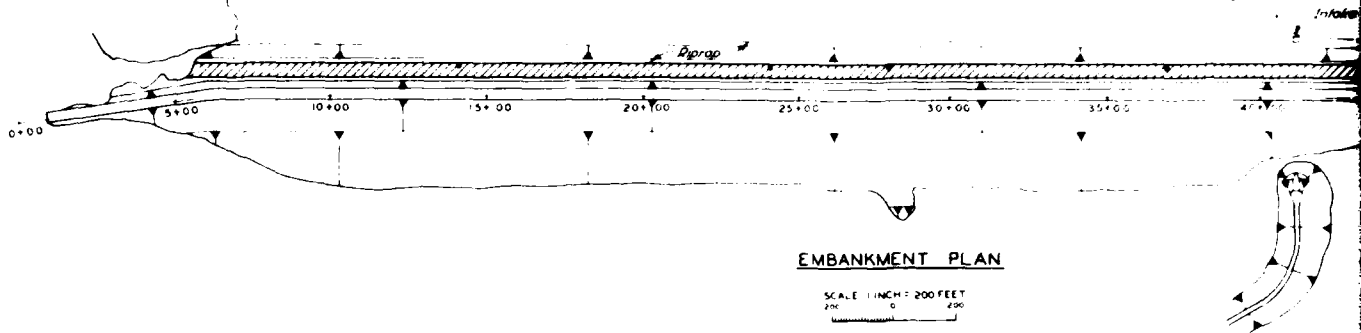


THIS DRAWING WAS PREPARED BY THE U.S. ARMY ENGINEER DISTRICT, OMAHA, NEBRASKA



REVISIONS	
DATE	DESCRIPTION

U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	
DESIGNED BY:	BALT CREEK AND ITS TRIBUTARIES, NEAR
DRAWN BY:	SITE 18
CHECKED BY:	BRANCHED OAK DAM
APPROVED BY:	STILLING BASIN DETAILS
DATE:	
SCALE:	
BY:	
DATE:	

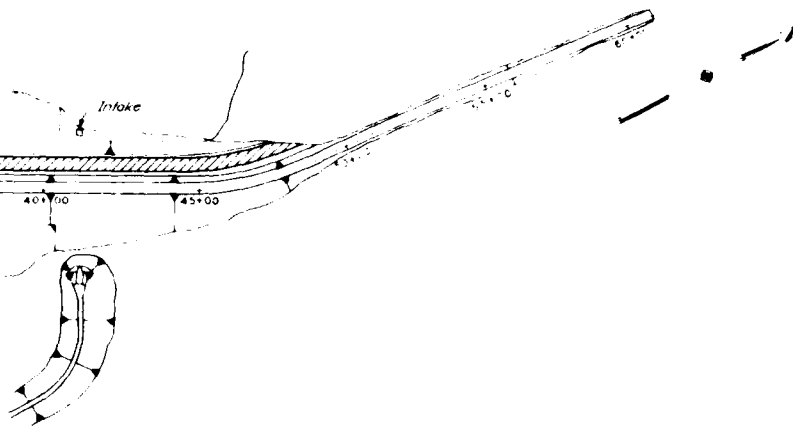


Quantity Computations

Excavation for Berm	$3.5 \times \frac{47}{27} \times 432$
Excavation for Topsoil	$0.75 \times \frac{27}{27} \times 432$
Total Excavation	
Topsoil Backfill	1.3×432
Rock Surfacing	$0.75 \times 20 \times 432 \times 6$
Seeding	$40 \times 432 \times 4 \times 1.5$
	43,560

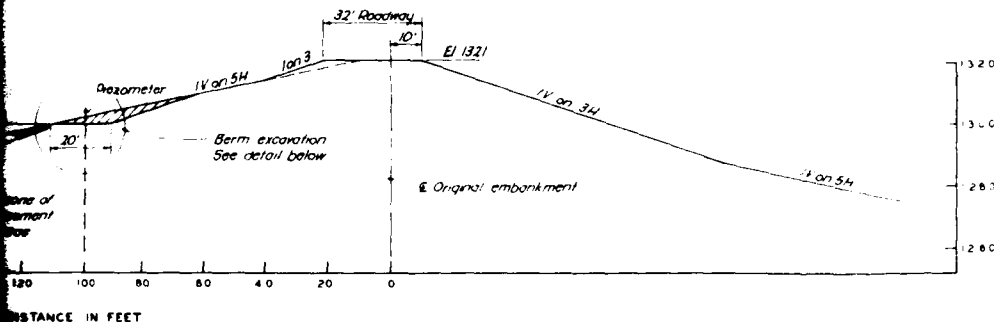
EMBANKMENT PLAN

SCALE 1 INCH = 200 FEET
0 200 400



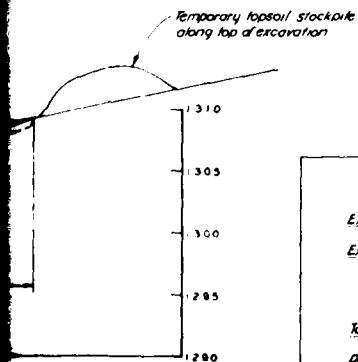
LEGEND:

- Area of Excavation for Berm Construction
- Piezometer to be Altered



TYPICAL SECTION

SCALE 1 INCH = 20 FEET
20 0 20



Quantity Computations

$$\begin{aligned} \text{Excavation for Berm} &= \frac{3.5 \times \frac{1}{2} \times 4300}{27} = 13,100 \text{ CY} \\ \text{Excavation for Topsoil} &= \frac{0.75 \times 20' \times 4300}{27} = 3,300 \text{ CY} \\ \text{Total Excavation} &= 16,400 \text{ CY} \end{aligned}$$

$$\begin{aligned} \text{Topsoil Backfill} &= 3,300 \text{ CY} \\ \text{Rock Surfacing} &= \frac{0.75 \times 20' \times 4300 \times 1.65}{27} = 3,975 \text{ Tons} \\ \text{Seeding} &= \frac{40 \times 4300}{43,560} = 4 \text{ Acres} \end{aligned}$$



THIS PLAN ACCOMPANIES CONTRACT NO. D4CAG5 MODIFICATION NO.

DATE	DESCRIPTION	MADE	APPROVED
	REV. 5-0-1		
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA			
SALT CREEK BRANCHED OAK DAM AND RESERVOIR EMBANKMENT BERM PLAN AND SECTION			
DESIGNED BY	APPROVED	DATE	
DRAWN BY	CHIEF ENGINEERING DIVISION	APRIL 67	
CHECKED BY	SCALE AS SHOWN	D4CAG5	
ENGINEER	ENGINEER	REVISION NUMBER	

APPENDIX B
PHOTOGRAPHS



PHOTO NO. 1 - October 1973, aerial view of project. Pool elevation is 1286.6, approximately 2.6' above normal operating pool. Note: This is the highest pool elevation ever recorded at Branched Oak Dam.



PHOTO NO. 2 - October 1973, aerial view of project.
High pool condition.

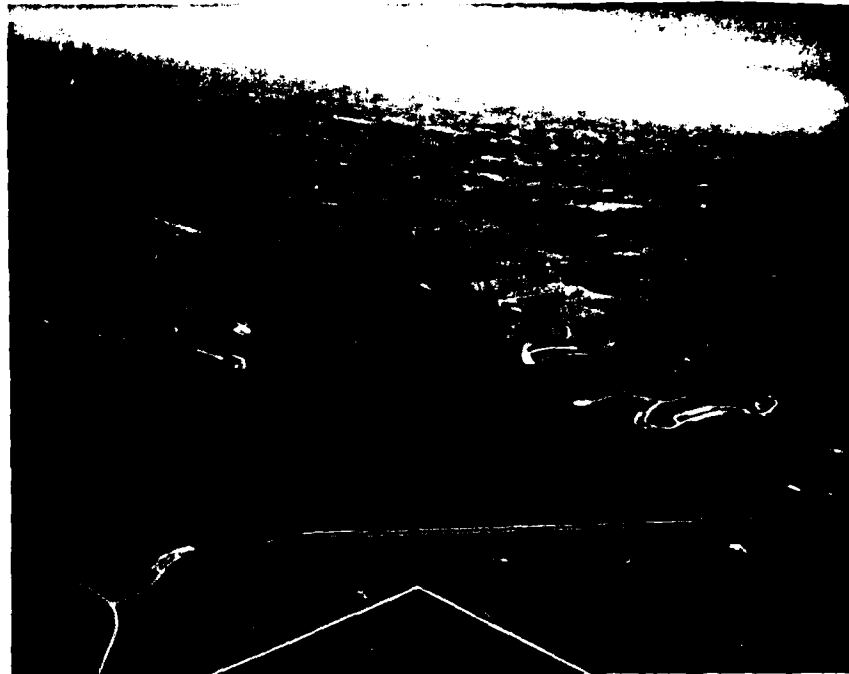


PHOTO NO. 1 - October 1973, aerial view of project. Pool elevation is 1286.6, approximately 2.6' above normal operating pool. Note: This is the highest pool elevation ever recorded at Branched Oak Dam.



PHOTO NO. 2 - October 1973, aerial view of project.
High pool condition.



PHOTO NO. 3 - October 1973, aerial view of project. High pool condition. Note: Emergency spillway is shown in the lower right hand side of the photo.

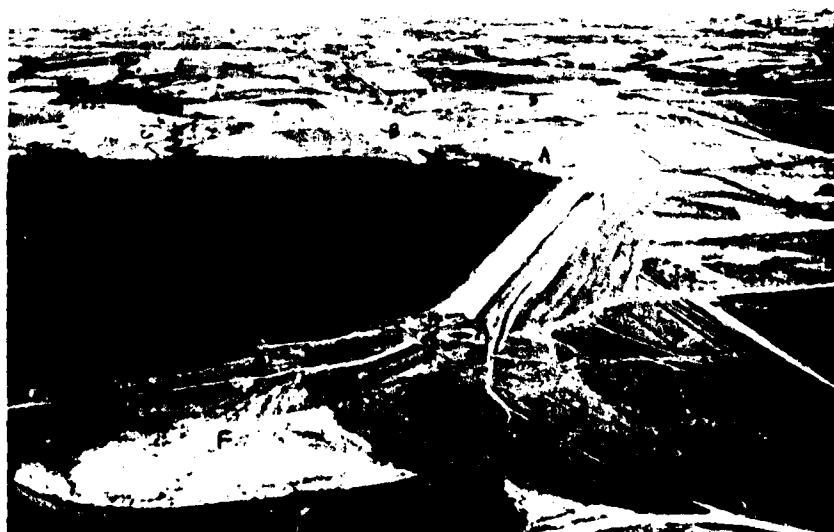


PHOTO NO. 4 - August 1968, aerial view of project during ponding of the reservoir. Note: Letters indicate Borrow Areas A, B, C and F and the Emergency Spillway(S).



PHOTO NO. 5 - View of upstream embankment slope, crushed rock surfaced service road, and upstream slope riprap protection from the left abutment. September 1982



PHOTO NO. 6 - View of upstream embankment slope, crushed rock surfaced service road, and upstream slope riprap protection from the right abutment. September 1982



PHOTO NO. 7 - Overview of dam crest, downstream slope, and right abutment. September 1982

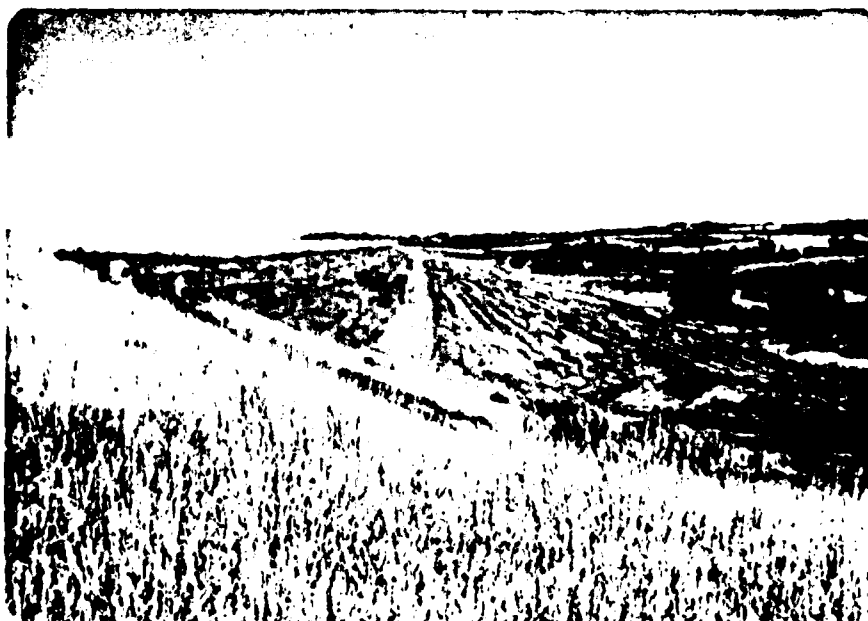


PHOTO NO. 8 - View of downstream slope of the dam from the right abutment. September 1982



PHOTO NO. 9 - View of upstream embankment slope, crushed rock surfaced service road, riprap slope protection and outlet works intake tower, from the left abutment. September 1982



PHOTO NO. 10 - View of riprap slope protection on the IV on 3H upstream embankment slope. September 1982



PHOTO NO. 11 - View of riprap slope protection on right
abutment shoreline area. September 1982



PHOTO NO. 12 - View of upstream end of emergency spillway.
Highway shown crosses dam to left.
September 1982



PHOTO NO. 13 - View of emergency spillway channel looking
downstream from near highway.
September 1982

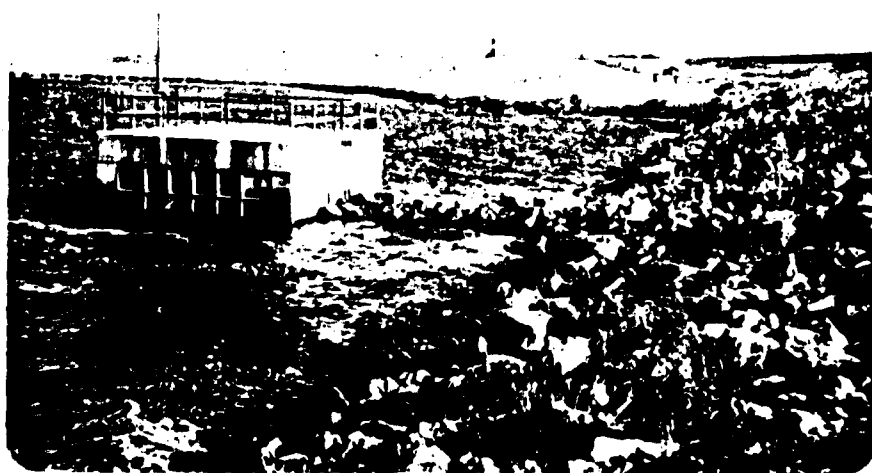


PHOTO NO. 14 - View of outlet works intake structure and
riprap near north end of the embankment.
September 1982

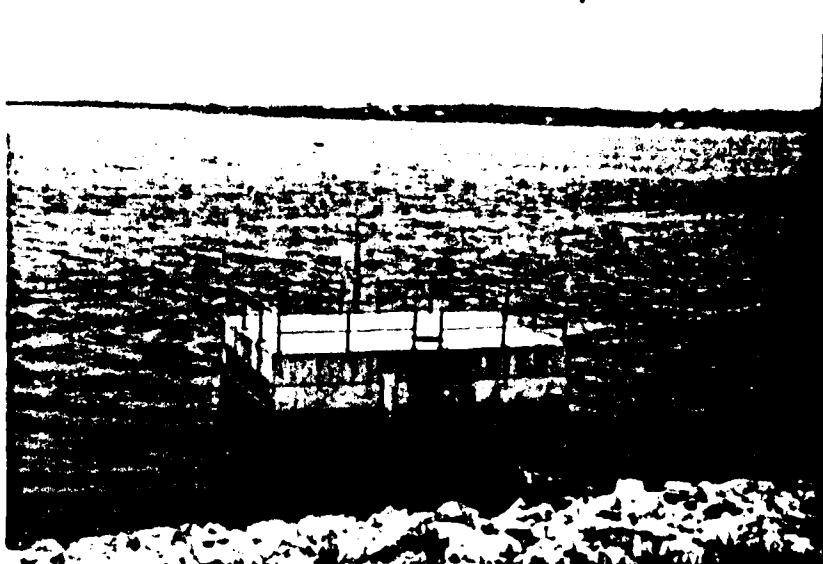


PHOTO NO. 15 - View of outlet works intake structure at
conservation pool level. (1284.0' m. s. l.)
May 1974

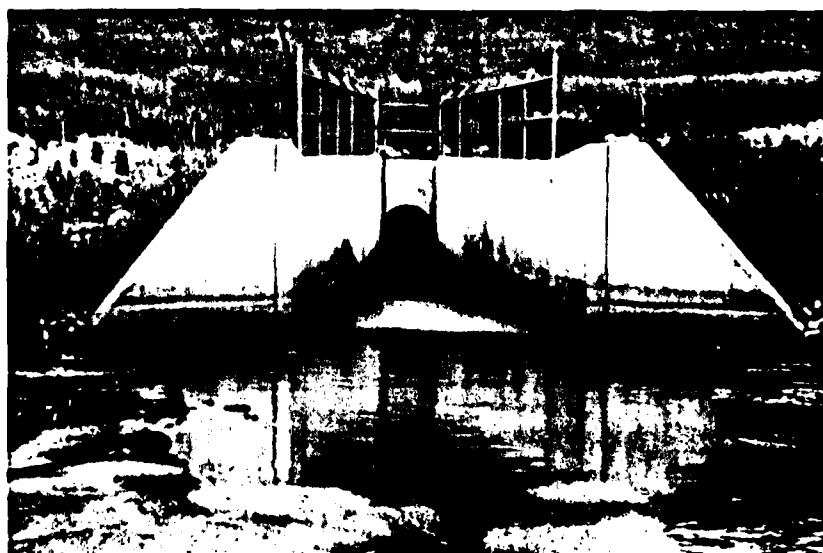


PHOTO NO. 16 - View of stilling basin structure and conduit
portal. June 1974



PHOTO NO. 17 - View of hydraulic jump created in stilling basin.
The jump dissipates the energy of the flowing water,
and therefore reduces erosion in the downstream
channel. April 1973



PHOTO NO. 18 - View of stilling basin and discharge channel.
September 1982



PHOTO NO. 19 - View of outlet channel from crest of dam.
September 1982

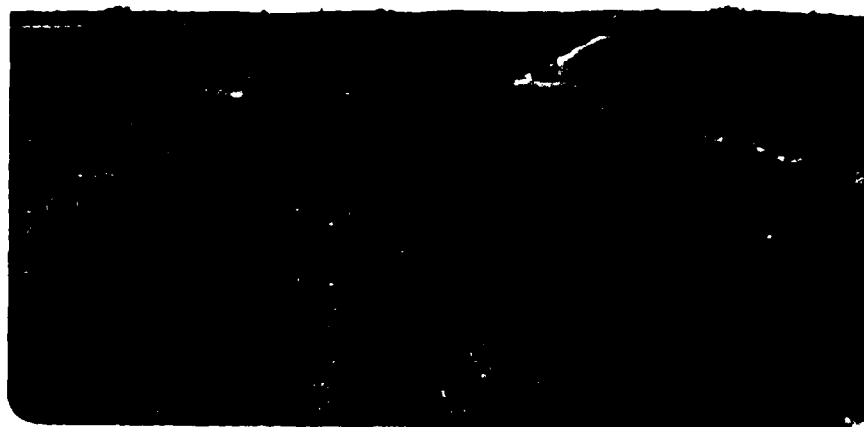


PHOTO NO. 20 - View of crushed rock surfaced service road
during construction. November 1976



PHOTO NO. 21 - View of crushed rock surfaced service road during construction. November 1976



PHOTO NO. 22 - View of outlet end of downstream valley relief well (on right side - flap lid) and parallel drain pipe (to left w/screen). Relief well flow is about 17 gpm and drain flow is about 5 gpm. September 1982

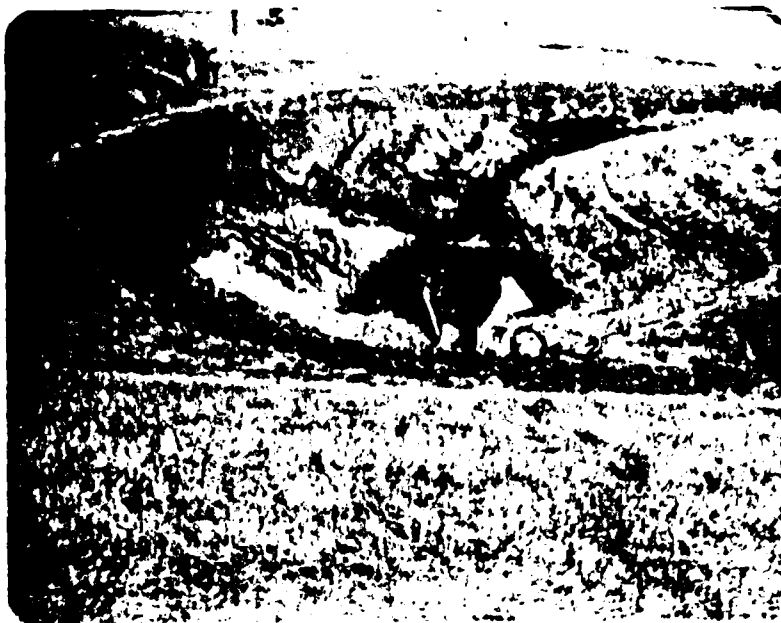


PHOTO NO. 23 - View of stilling basin from crest of dam.
 Arrow #1 points to 4' seepage drain
 (See Photo No. 25) and Arrow #2 points to
 a 2' seepage drain (See Photo No. 24). September 1982



PHOTO NO. 24 - View of 2' seepage drain which was installed
 in the outlet end of an embankment sand drain
 just upstream of the stilling basin structure.
 Flow is approx. 1.4 gpm. September 1982



PHOTO NO. 25 - View of 4" seepage drain installed along the left crest slope of the stilling basin. Flow is approx. 23.5 gpm. September 1982

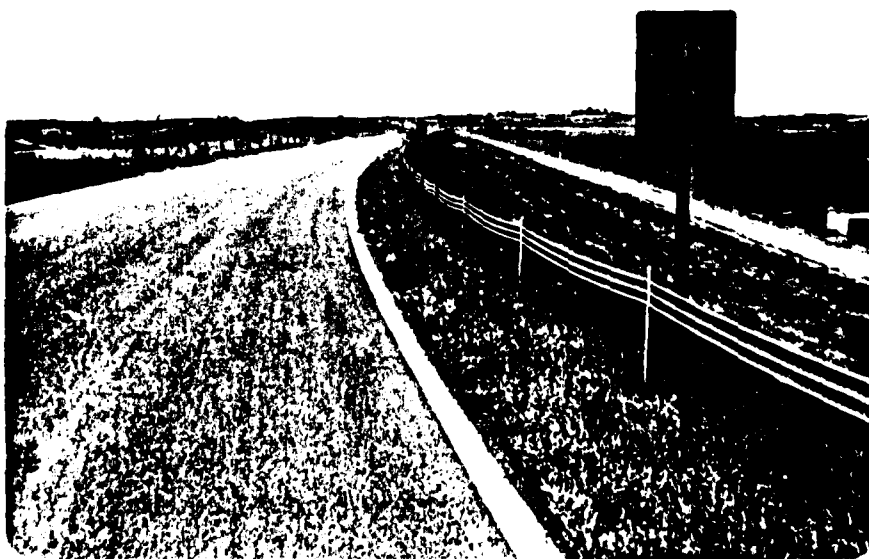
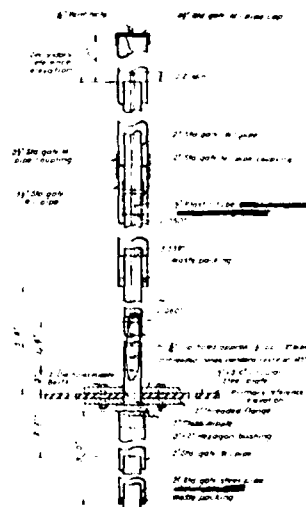
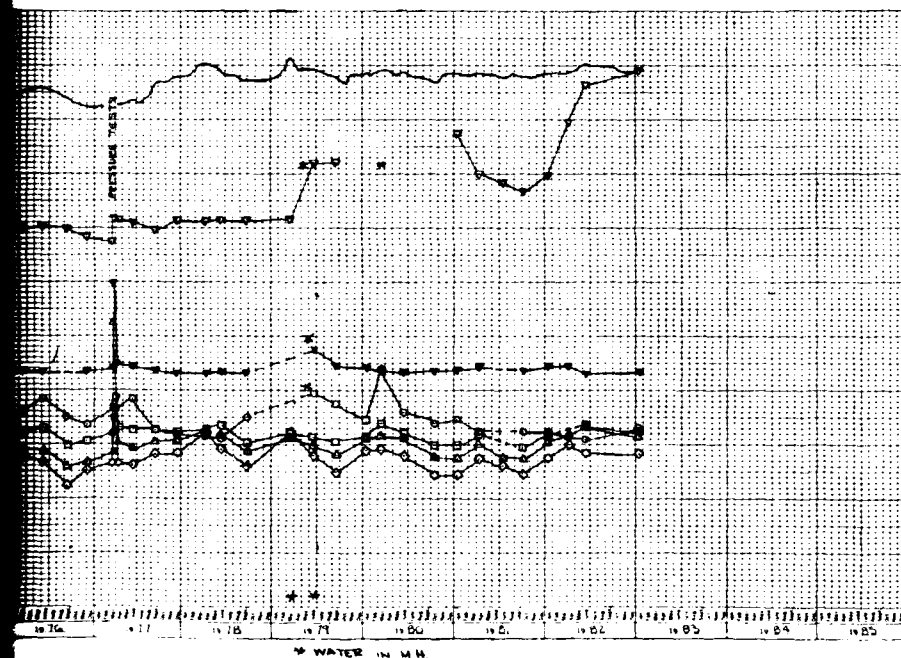


PHOTO NO. 26 - View of dam crest and paved highway which runs along the crest of the dam. Photo was taken from the upstream side of the embankment near the left abutment. September 1982



PHOTO NO. 27 - View of dam crest and paved highway which runs along the crest of the dam. Photo was taken from near the right abutment of the dam. September 1982

APPENDIX C
INSTRUMENTATION



COMMITTEE ON THE JUDICIAL BRANCH
DEPARTMENT OF JUSTICE
WASHINGTON, D.C.

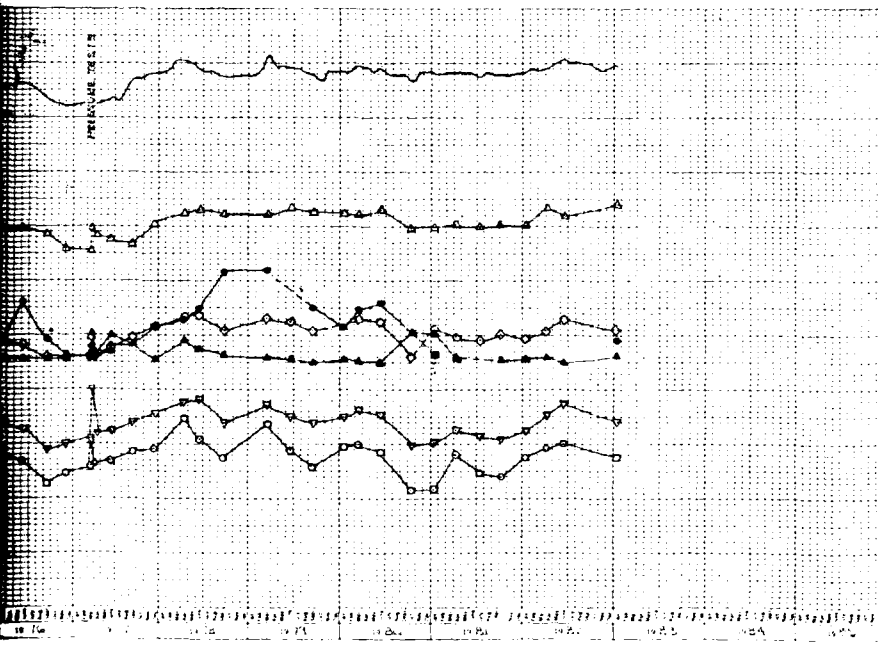
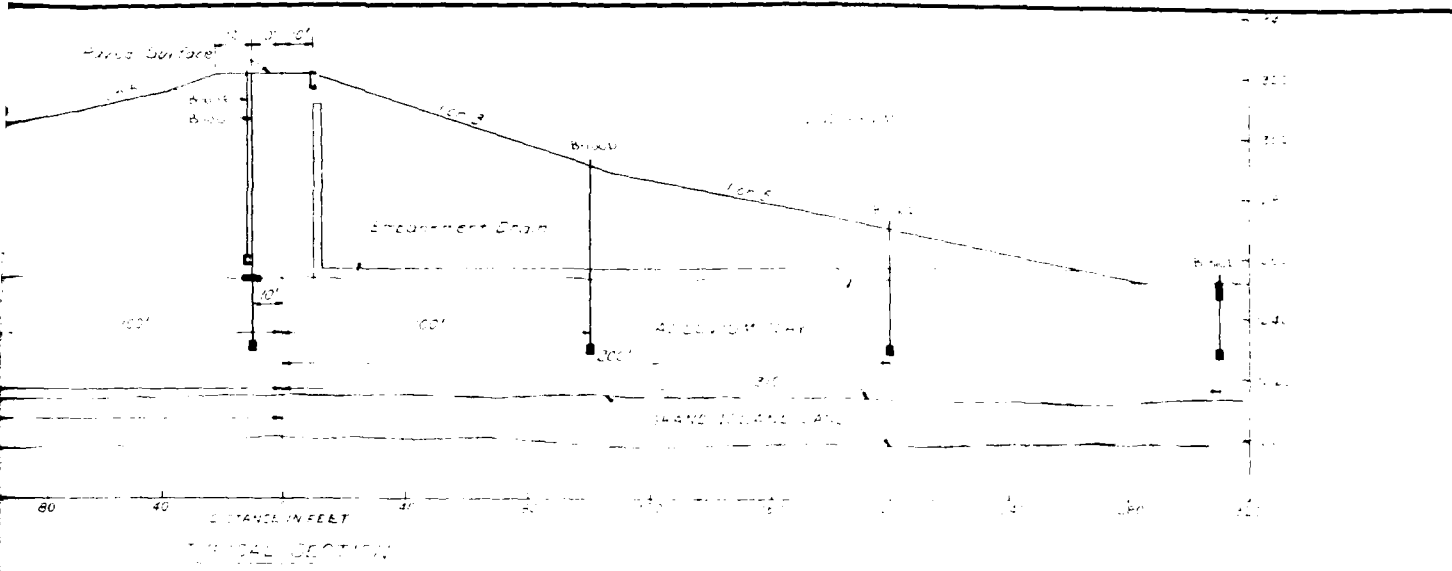
[illegible]

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983)

PLATE C2

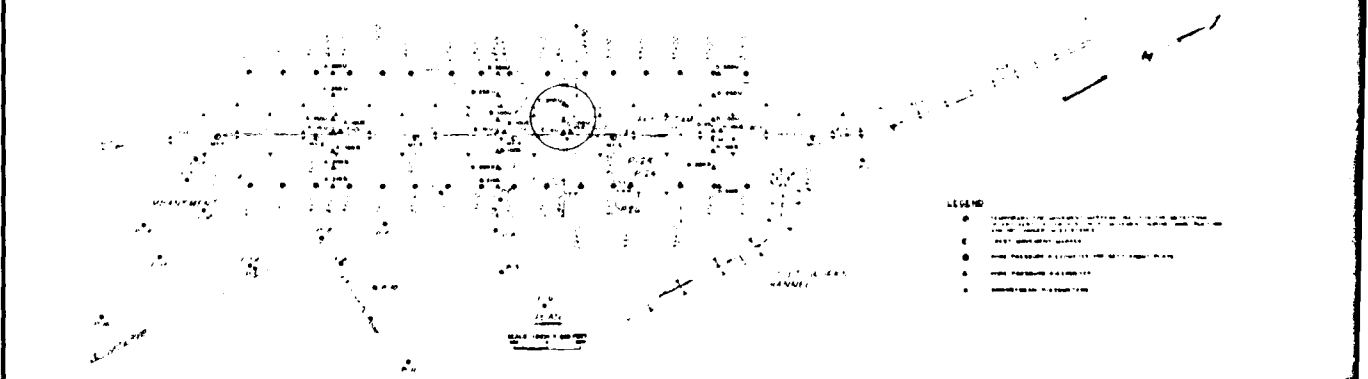
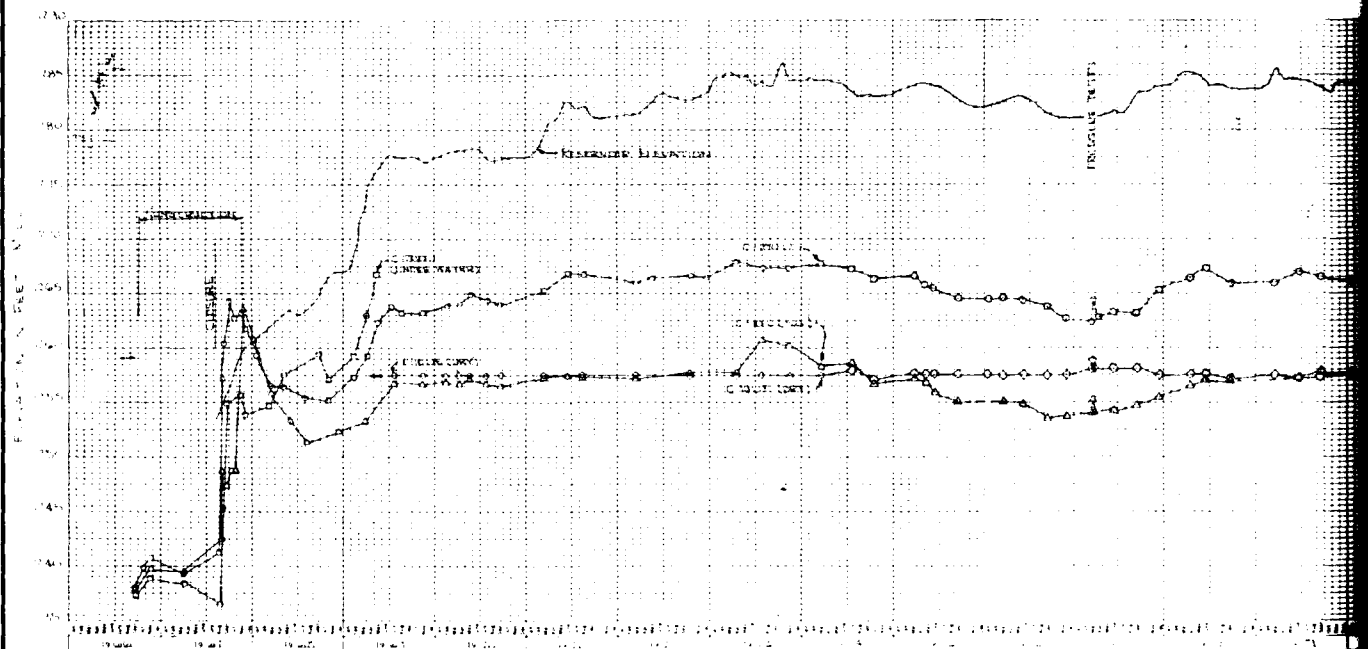
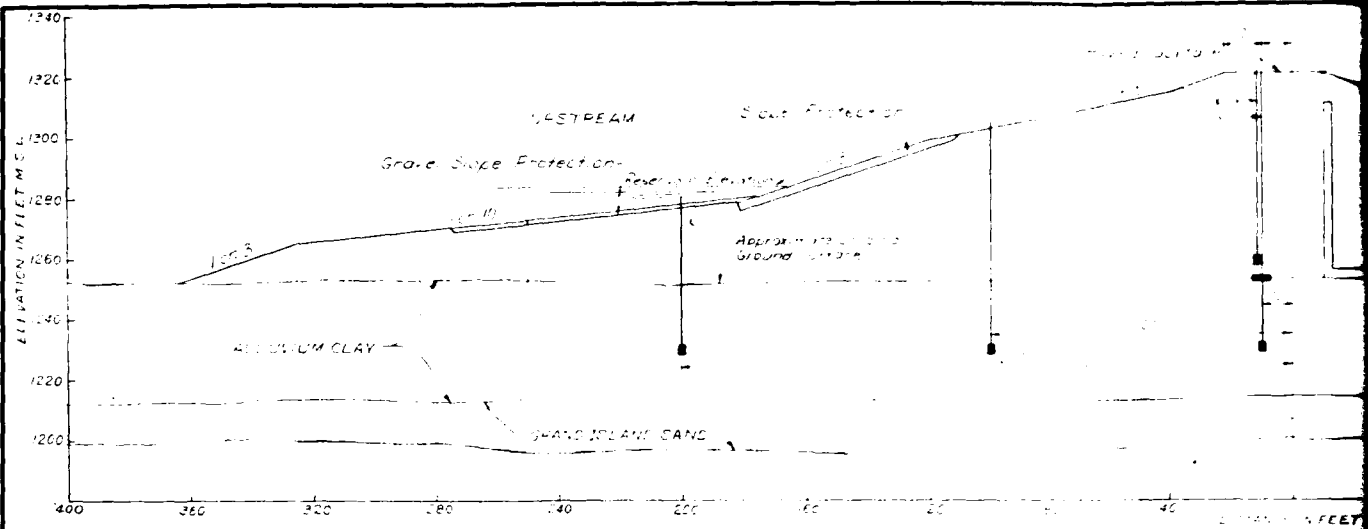


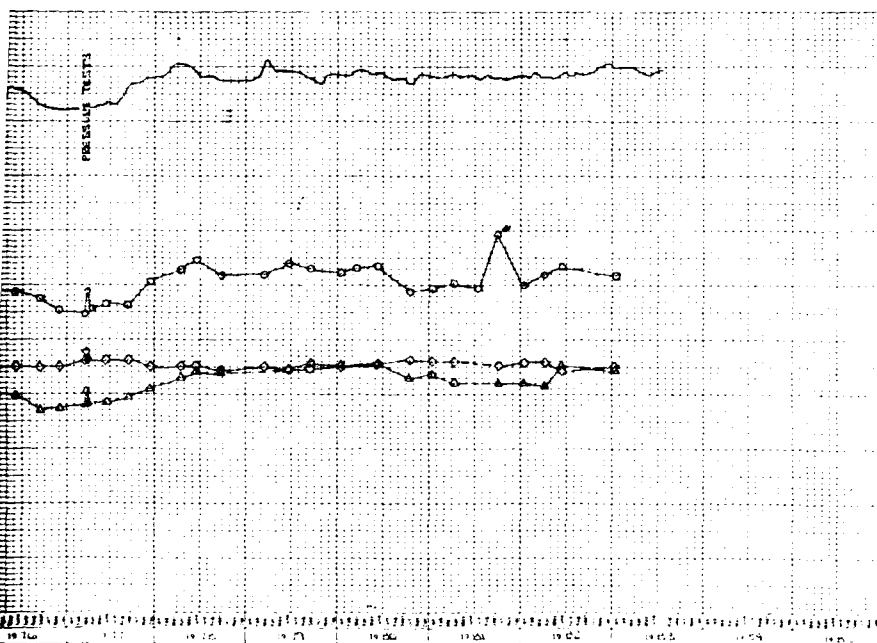
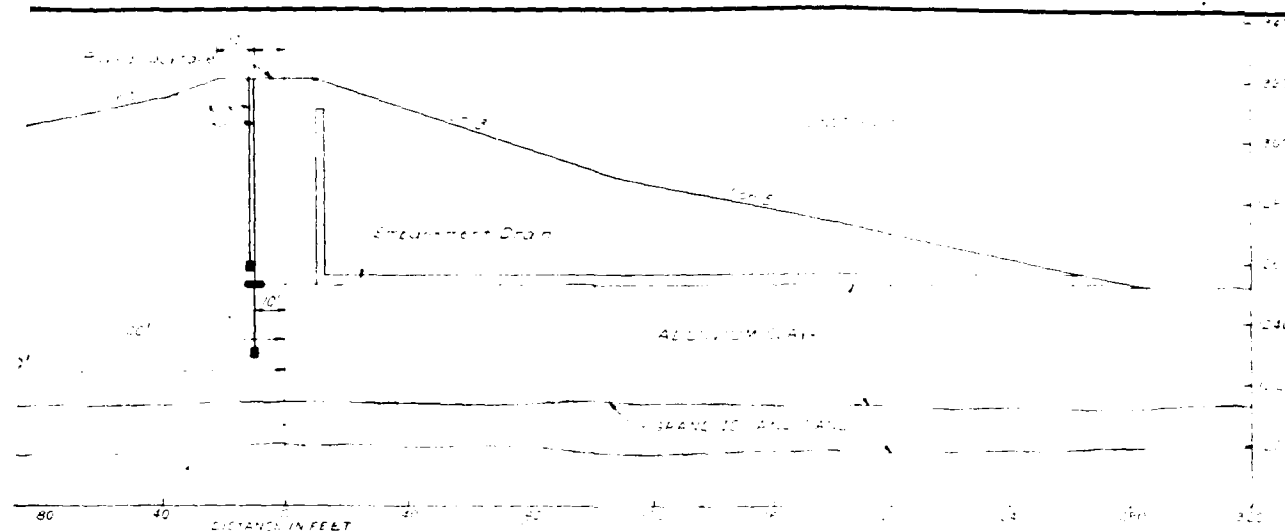
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.



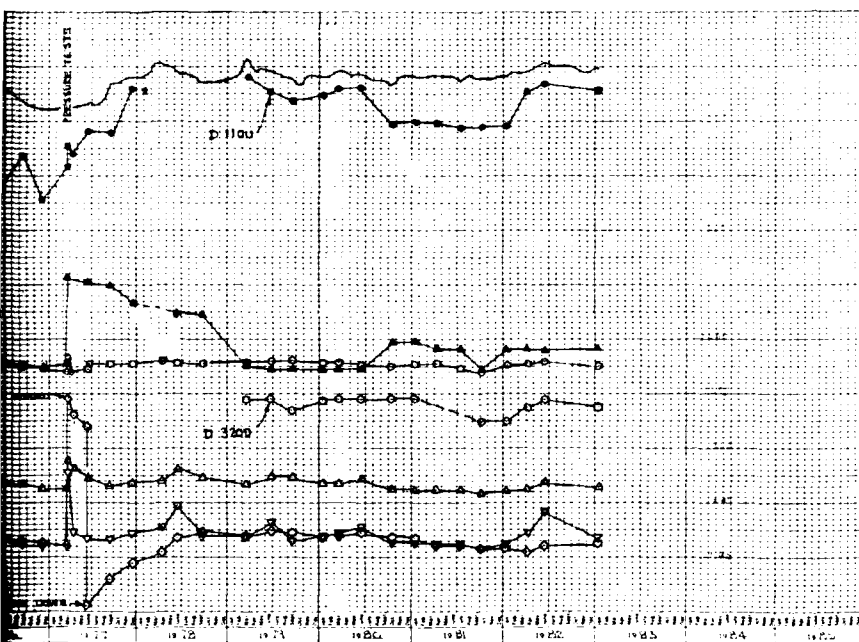
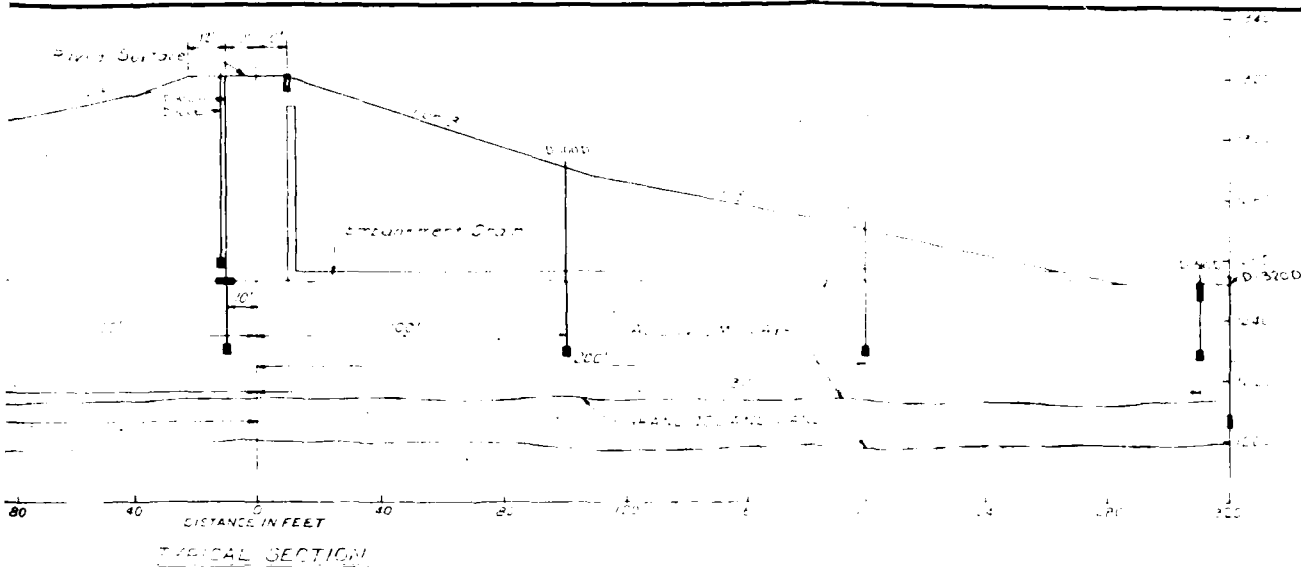
THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

DATE		DESCRIPTION		MADE	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DRAWN BY	CHECKED BY				
CHECKED BY	APPROVED BY				
DESIGNED BY	DATE				
DISTRICT	SECTION	APPROVED	DATE		
DISTRICT	SECTION	APPROVED	DATE		
APPROVED	SCALE AS SHOWN	DATE			
DESIGNED BY		APPROVED			



[illegible]

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1983)



* PIEZ D-1000 NG REPLACED
WITH PIEZ D1100
PIEZ. D320D IS AN ADDED
PIEZ. INSTALLED INTO THE G.I. SAND.

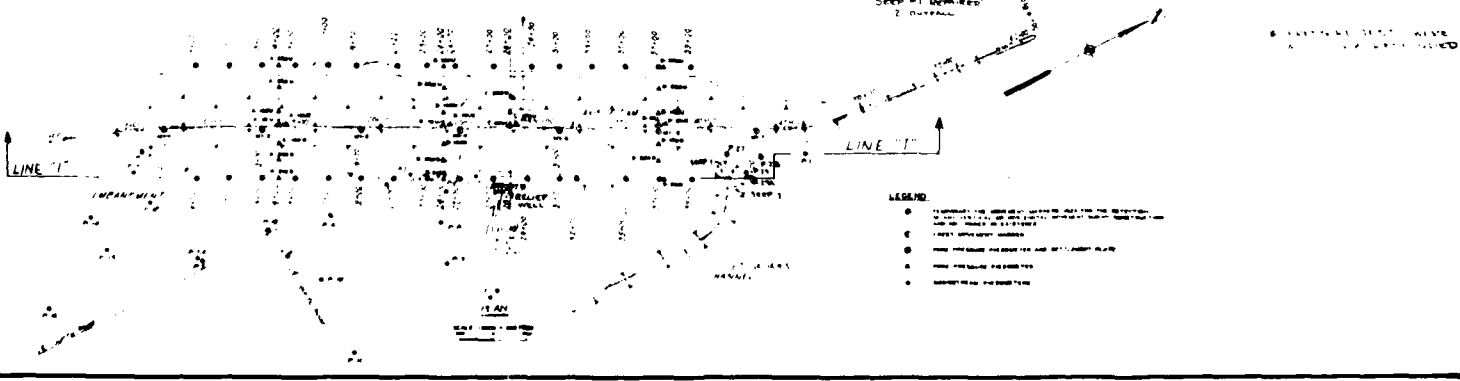
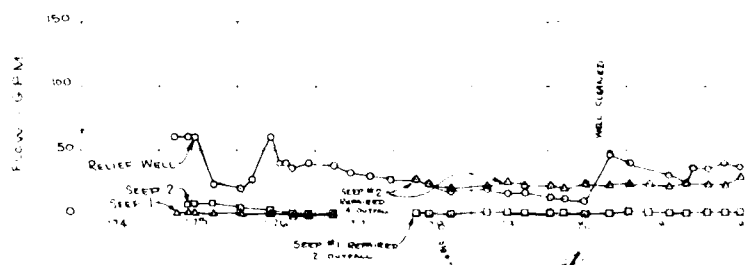
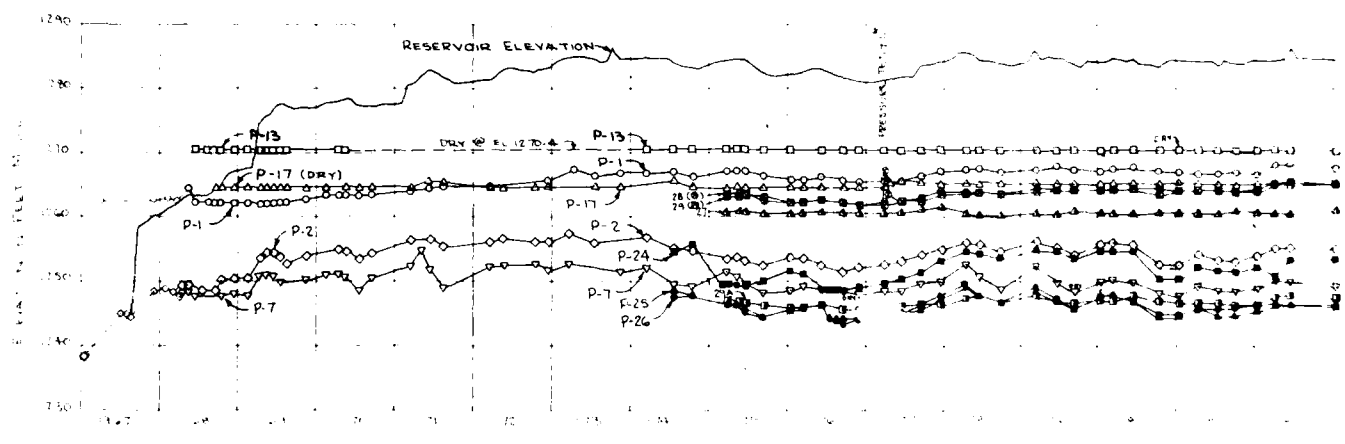
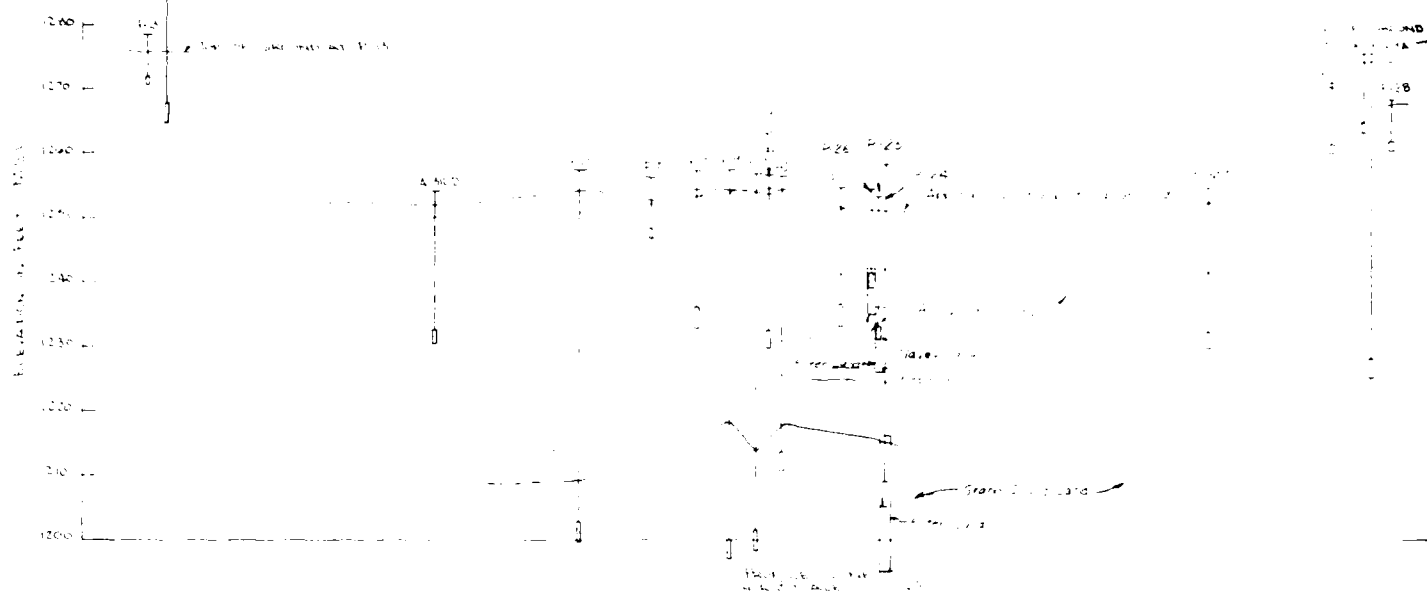


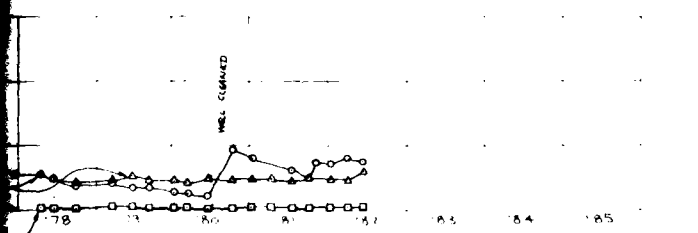
THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

[illegible]

EMBAKMENT CRITERIA AND PERFORMANCE REPORT 1983

DOI: 10.1002/for





1. 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
 2. 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
 3. 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
 4. 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
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 6. 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000
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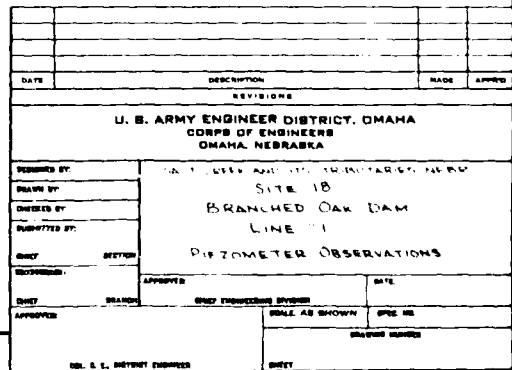
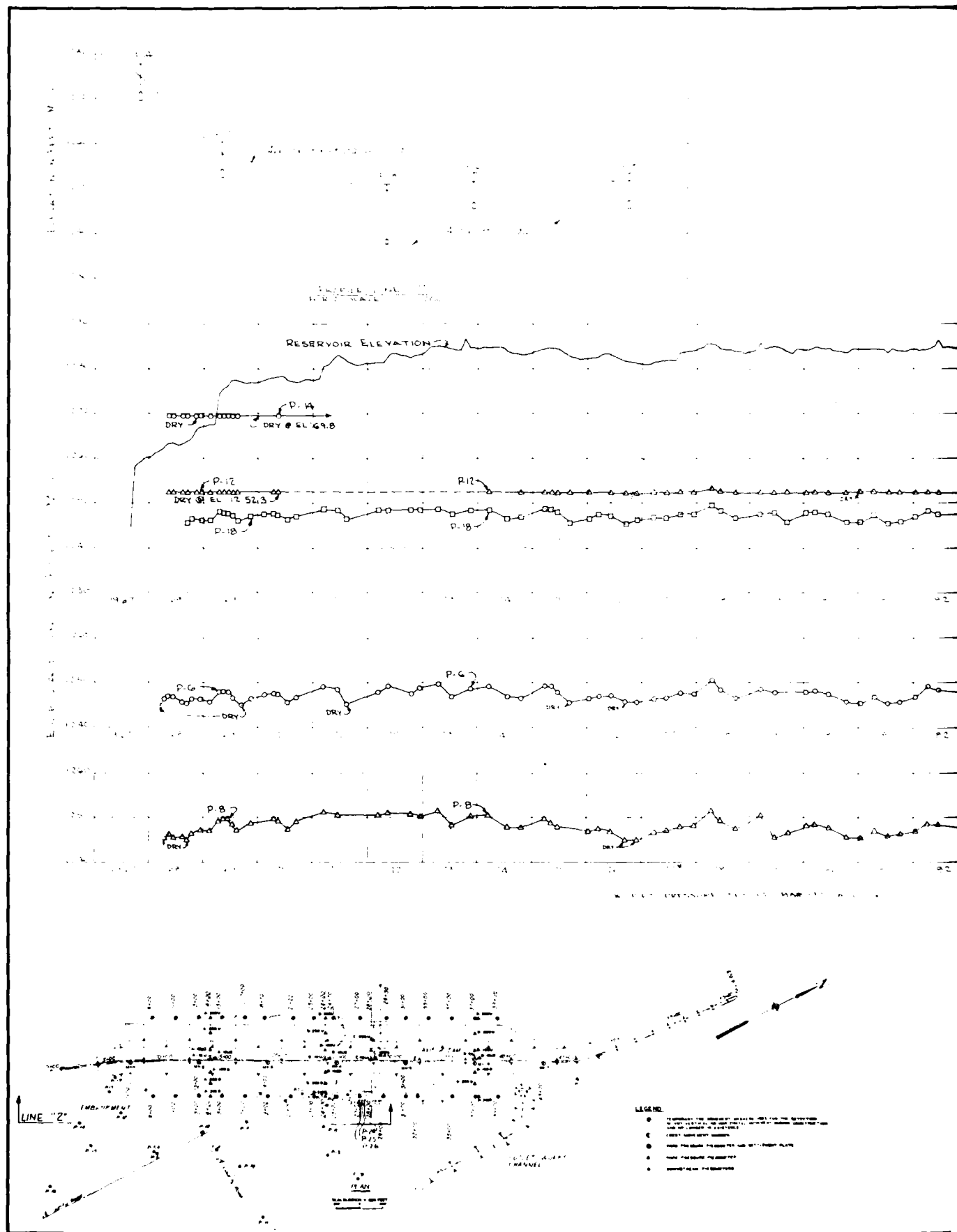
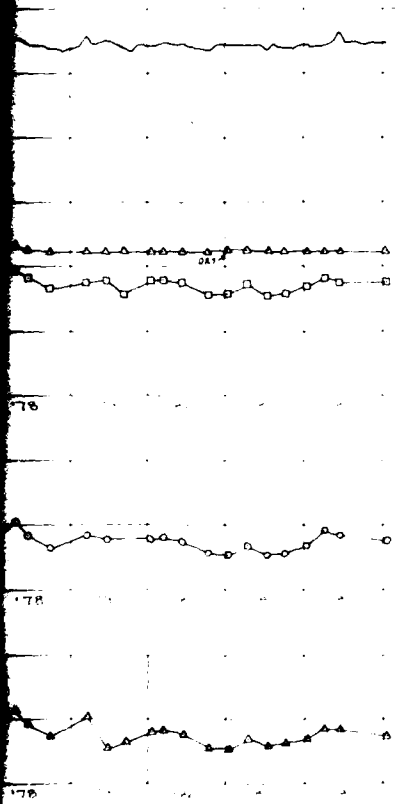


PLATE C6





SEE TECHNICAL MAP FOR LOCATION

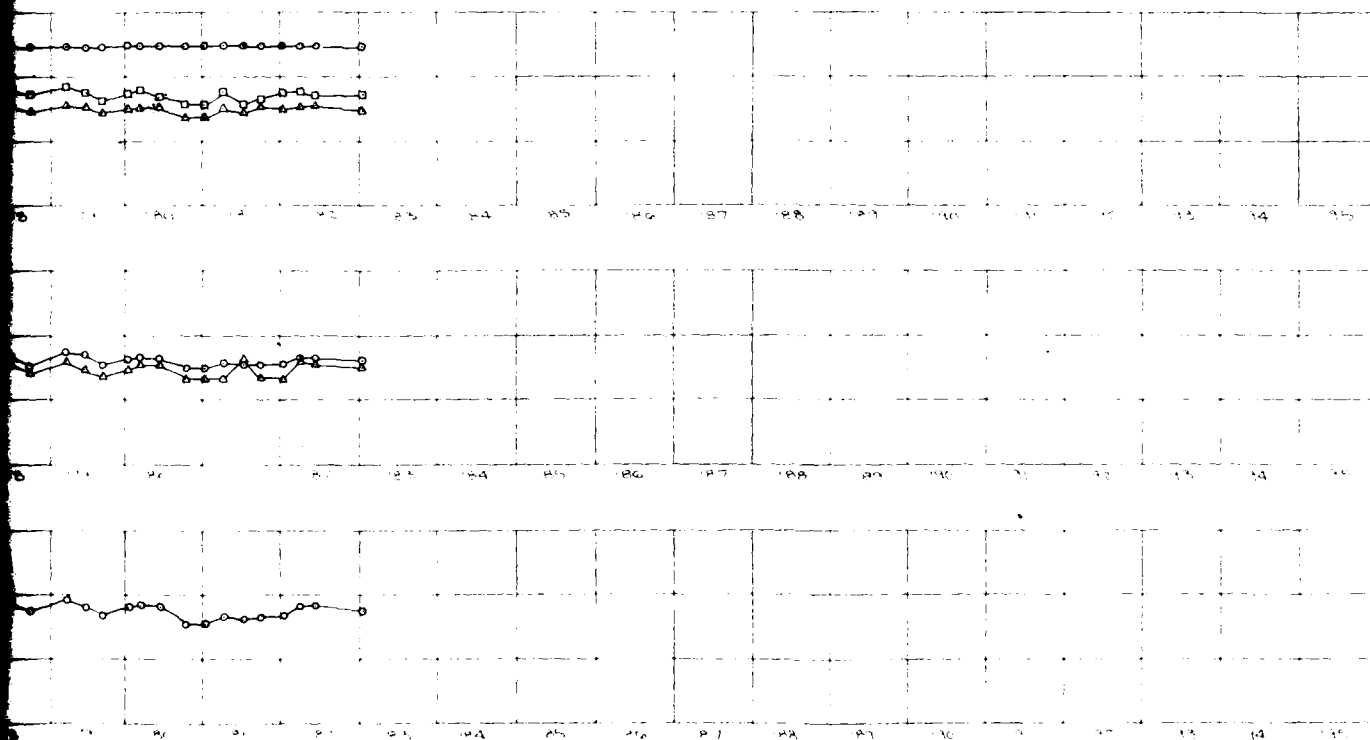


THE FOLLOWING INFORMATION IS FOR THE INFORMATION OF THE DISTRICT ENGINEER AND IS NOT TO BE USED FOR ANY OTHER PURPOSE.



THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

DATE		DESCRIPTION		NAME	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:		SITE 18 BRANCHED OAK DAM LINE "2" PIEZOMETER OBSERVATIONS			
DRAWN BY:					
CHECKED BY:					
SUBMITTED BY:					
SUPERVISOR:		APPROVED:		DATE:	
DESIGNED:		DRAWN:		CHECKED:	
APPROVED:		SCALE AS SHOWN		SHEET NO.	
				DRAWING NUMBER	
		COL. R. E. BENTLEY ENGINEER		SHEET	

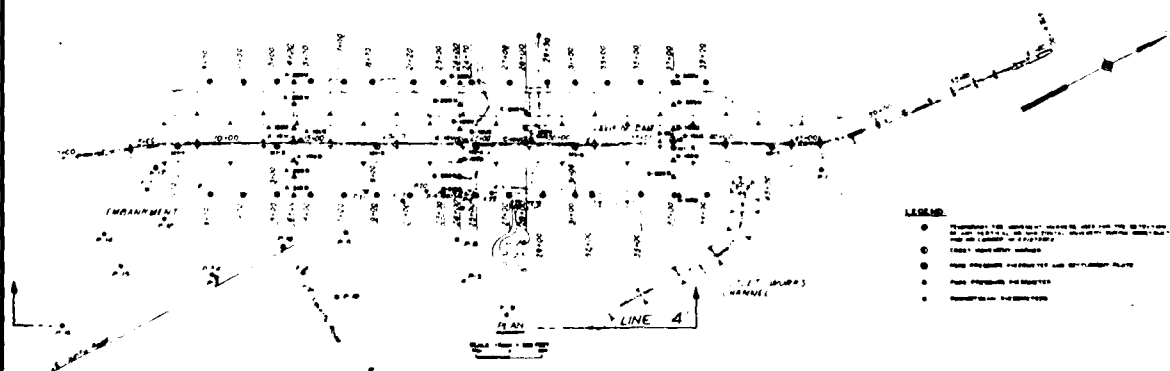
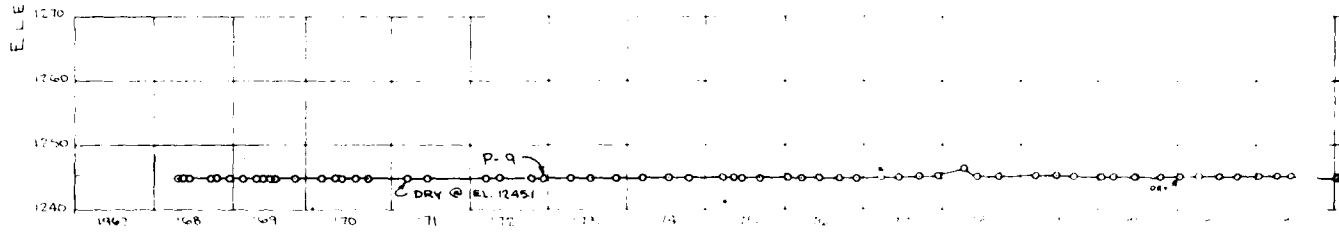


Note See Plate C-6 for Reservoir Elevation
 4 PIEZ PRESSURE TESTED MAR '77, ALL OK

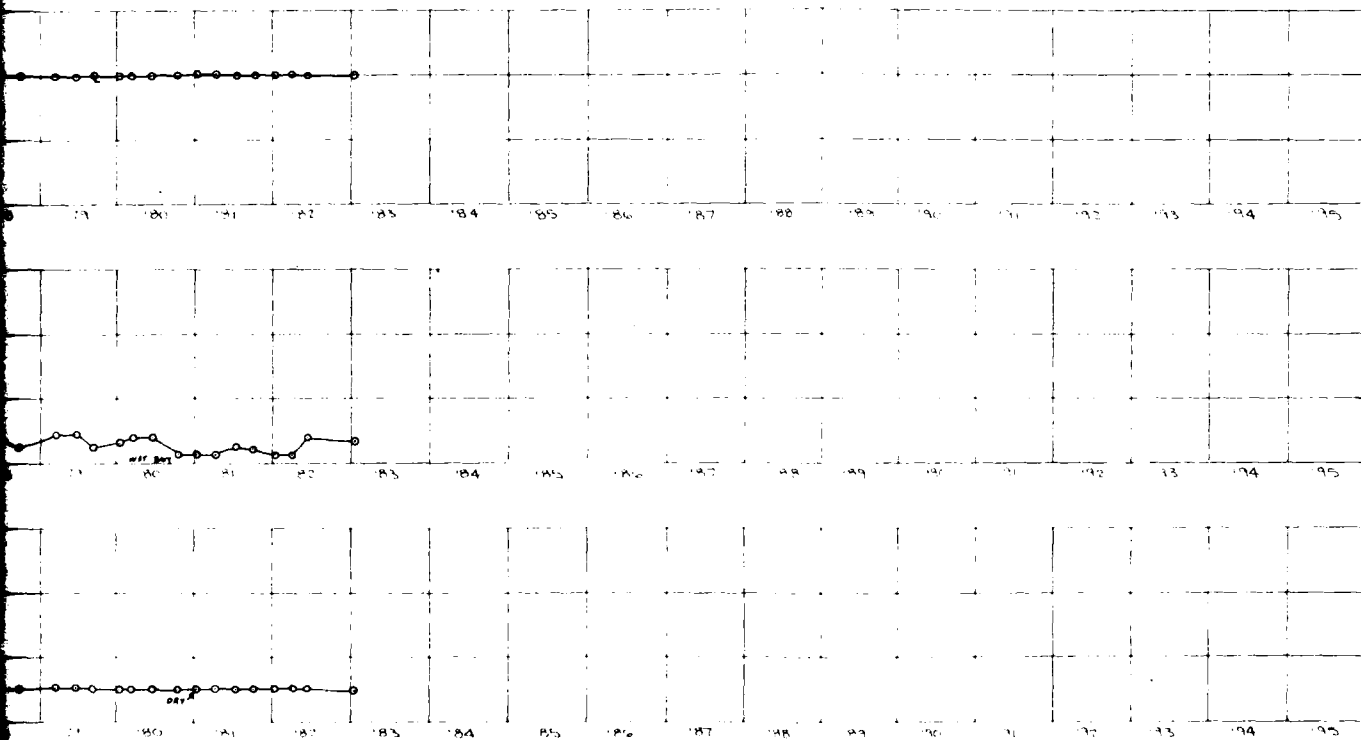


THIS PLAN ACCOMPANIES CONTRACT NO.
 MODIFICATION NO.

DATE		DESCRIPTION		NAME	APPROV
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY	SALT LAKE AND ITS TRIBUTARIES NEPA				
DRAWN BY	SITE 18				
CHECKED BY	BRANCHED OAK DAM				
APPROVED BY	LINE "3"				
DATE	SECTION	PIEZOMETER OBSERVATIONS			DATE
APPROVED	PLANS	APPROVED	DATE	DATE	DATE
APPROVED		APPROVED		DATE	DATE
APPROVED		APPROVED		DATE	DATE



p.9



10 MAR 1979 OK

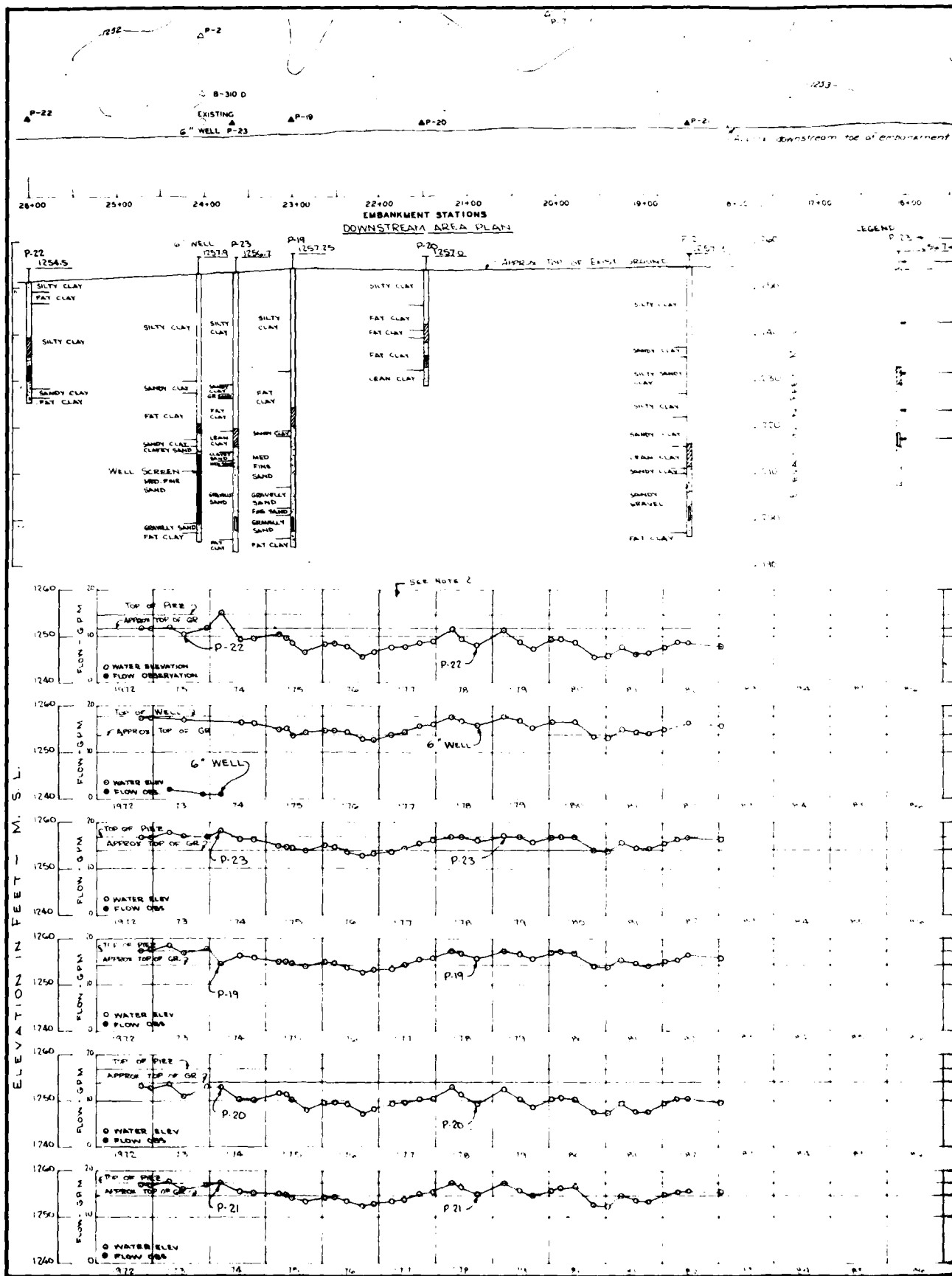
Note: See Plate C-6 for Reservoir Elevation



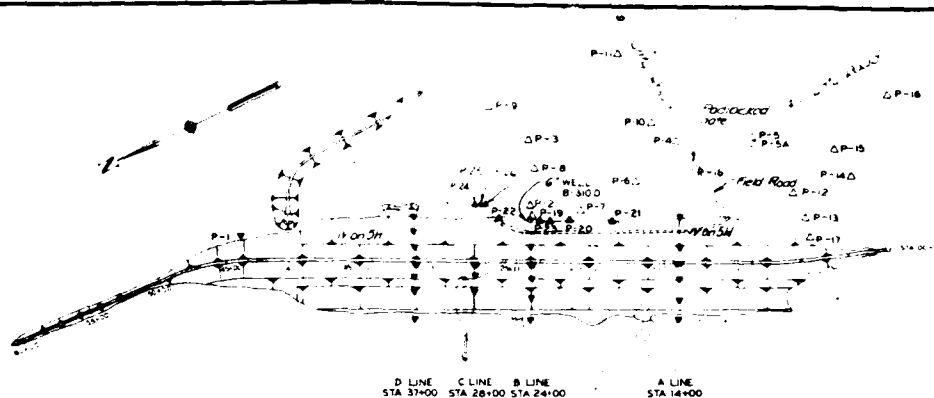
THIS PLAN ACCOMPANIES CONTRACT NO. MODIFICATION NO.

DATE		DESCRIPTION		MADE	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:	SALT CREEK AND ITS TRIBUTARIES, WYOMING				
DRAWN BY:	SITE 18				
REGISTERED BY:	BRANCHED OAK DAM				
DATE	SECTION	PIEZOMETER OBSERVATIONS			DATE
APPROVED	APPROVED	SCALE AS SHOWN			DATE
U.S. ARMY ENGINEER DISTRICT, OMAHA		ENGINEER			

12



Approx. downstream toe of embankment



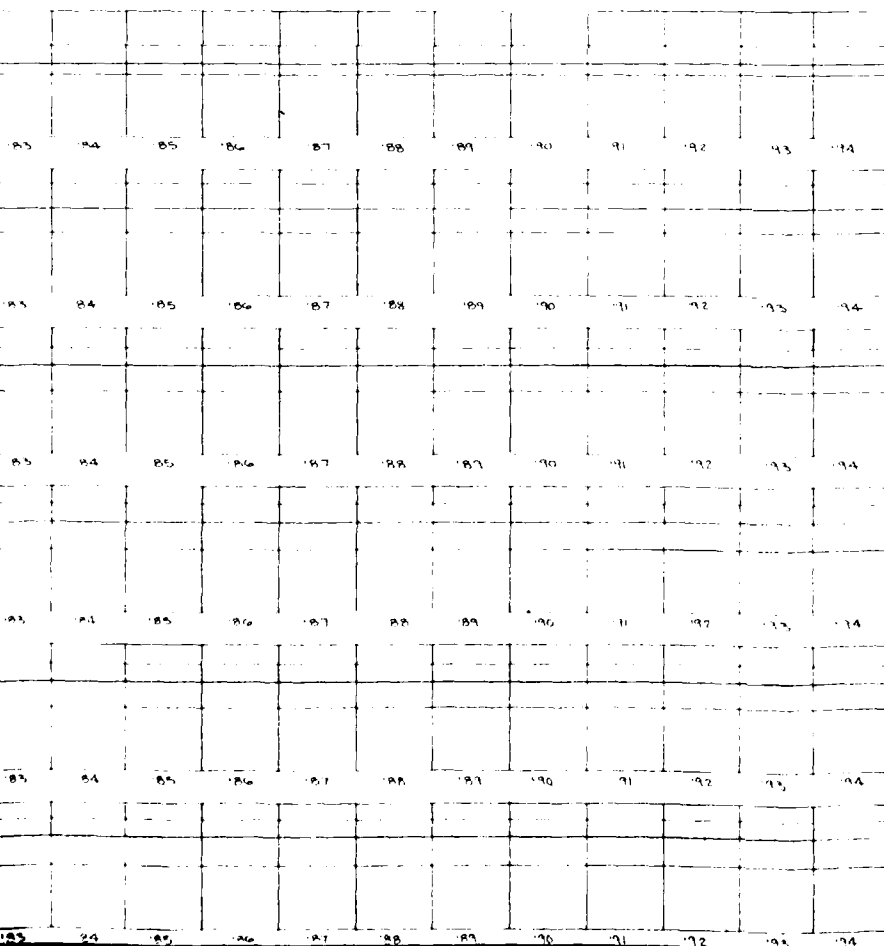
PLAN

SCALE 1 INCH = 400 FEET

LEGEND
P-23 ← PIEZ. NO.
125+7 ← TOP ELEV.
← PIEZ. TUBE

← IMPERVIOUS BACKFILL
← BENTONITE SEAL
← PERVIOUS SAND BACKFILL
← WELL POINT

ELEVATION IN FEET - 2.0

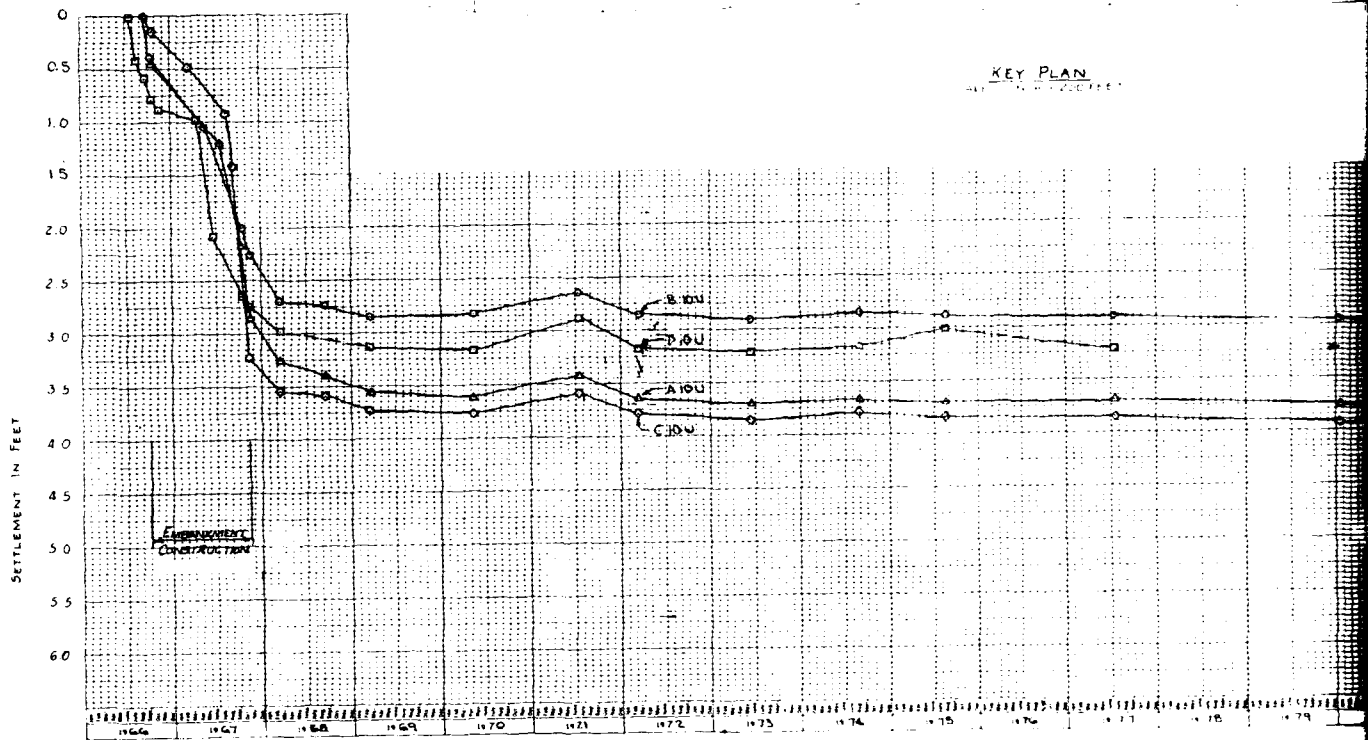


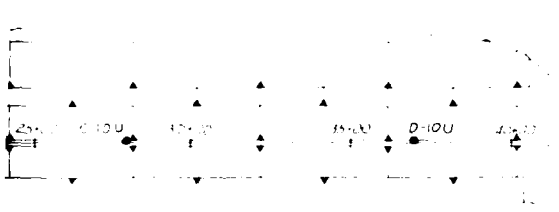
NOTE

See Plate C-6 for Reservoir Elevation

2 PIEZ. PRESSURE TESTED MAR 17, 1964

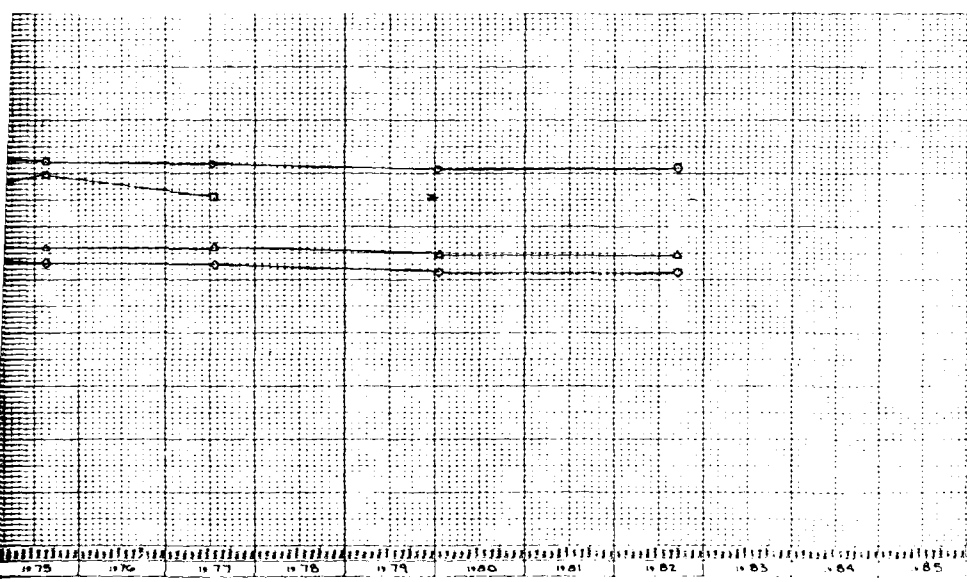
DATE		REVISIONS		NAME	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:	SALT REEF AND ITS TOWNSHIP, NEBRASKA				
DRAWN BY:	SITE 18				
CONSTRUCTED BY:	KRAMER, HILL, LAMM				
CONSTRUCTED BY:	DOWNSTREAM TOE ELEVATION OBSERVATIONS				
DESIGNED BY:	DATE	APPROVED	DATE		
DRAWN BY:	DATE	CONSTRUCTED BY:	DATE		
CONSTRUCTED BY:	DATE	CONSTRUCTED BY:	DATE		





Legend
 A-100 Settlement of slope

KEY PLAN
 SCALE 1" = 200 FEET

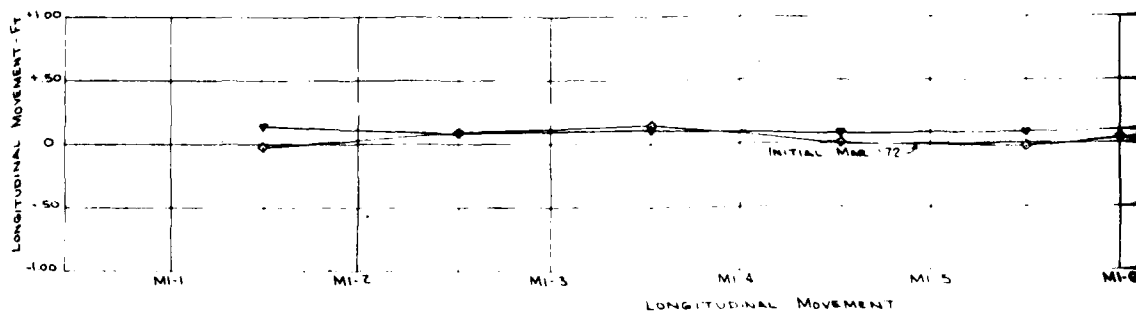
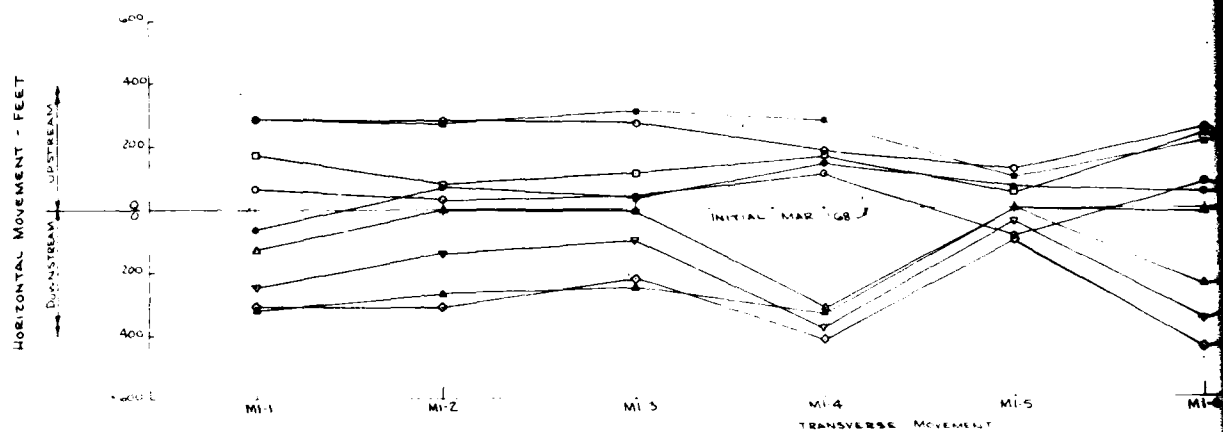
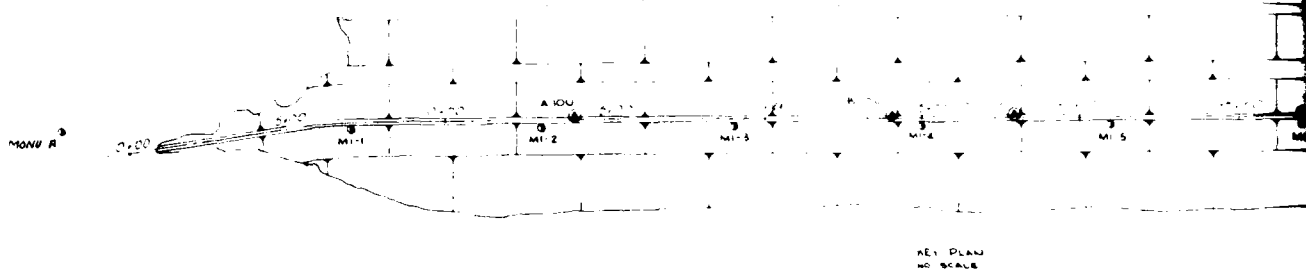


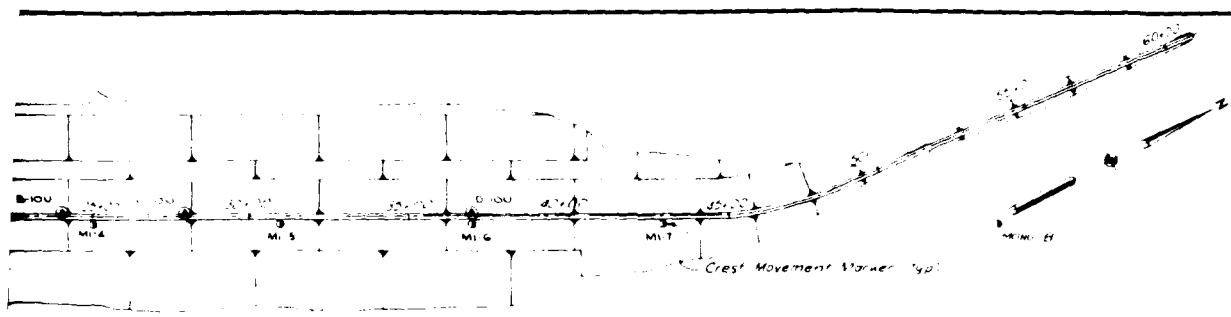
* D100 not surveyed Jan 80



THIS PLAN ACCOMPANIES CONTRACT NO. _____
 MODIFICATION NO. _____

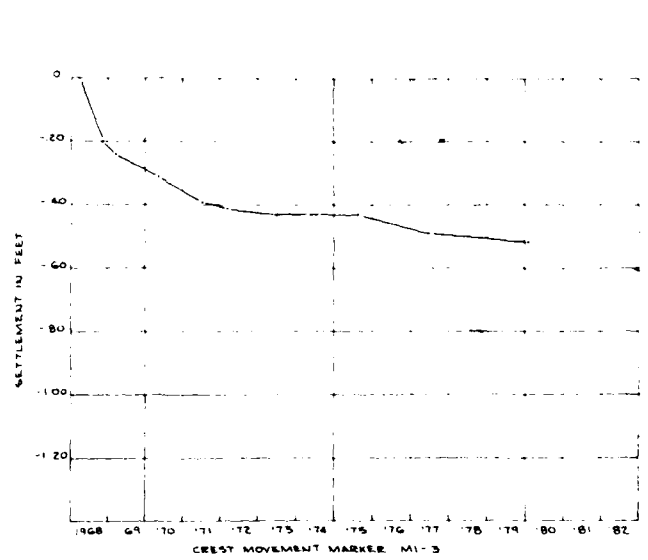
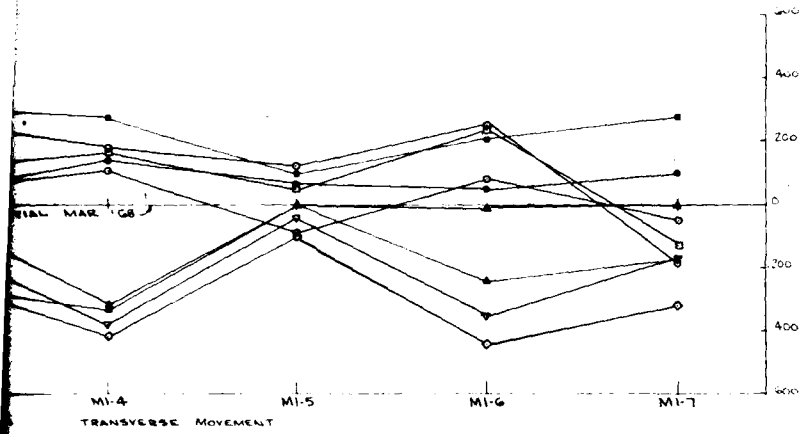
DATE		DESCRIPTION		DATE	APPROVED
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY		J. L. PIER AND J. L. TRANTANIS, NEBRASKA			
DRAWN BY		BRANCHED OAK DAM & RESERVOIR			
CHECKED BY		FOUNDATION SETTLEMENT DATA			
RIGHTS BY		VERTICAL MOVEMENT			
DATE	SECTION	DATE	SECTION	DATE	SECTION
1975	1	1976	2	1977	3
1978	4	1979	5	1980	6
1981	7	1982	8	1983	9
1984	10	1985	11	1986	12
1987	13	1988	14	1989	15
1990	16	1991	17	1992	18
1993	19	1994	20	1995	21
1996	22	1997	23	1998	24
1999	25	2000	26	2001	27
2002	28	2003	29	2004	30
2005	31	2006	32	2007	33
2008	34	2009	35	2010	36
2011	37	2012	38	2013	39
2014	40	2015	41	2016	42
2017	43	2018	44	2019	45
2020	46	2021	47	2022	48
2023	49	2024	50	2025	51
2026	52	2027	53	2028	54
2029	55	2030	56	2031	57
2032	58	2033	59	2034	60
2035	61	2036	62	2037	63
2038	64	2039	65	2040	66
2041	67	2042	68	2043	69
2044	70	2045	71	2046	72
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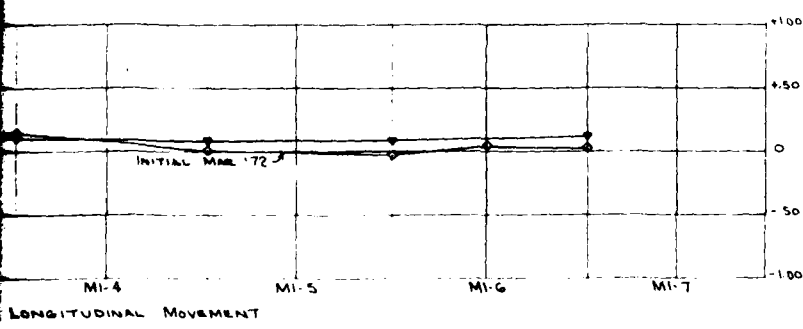


KEY PLAN
NO SCALE

LEGEND
 ○ CREST MOVEMENT MARKERS
 ● FOUNDATION SETTLEMENT MARKERS

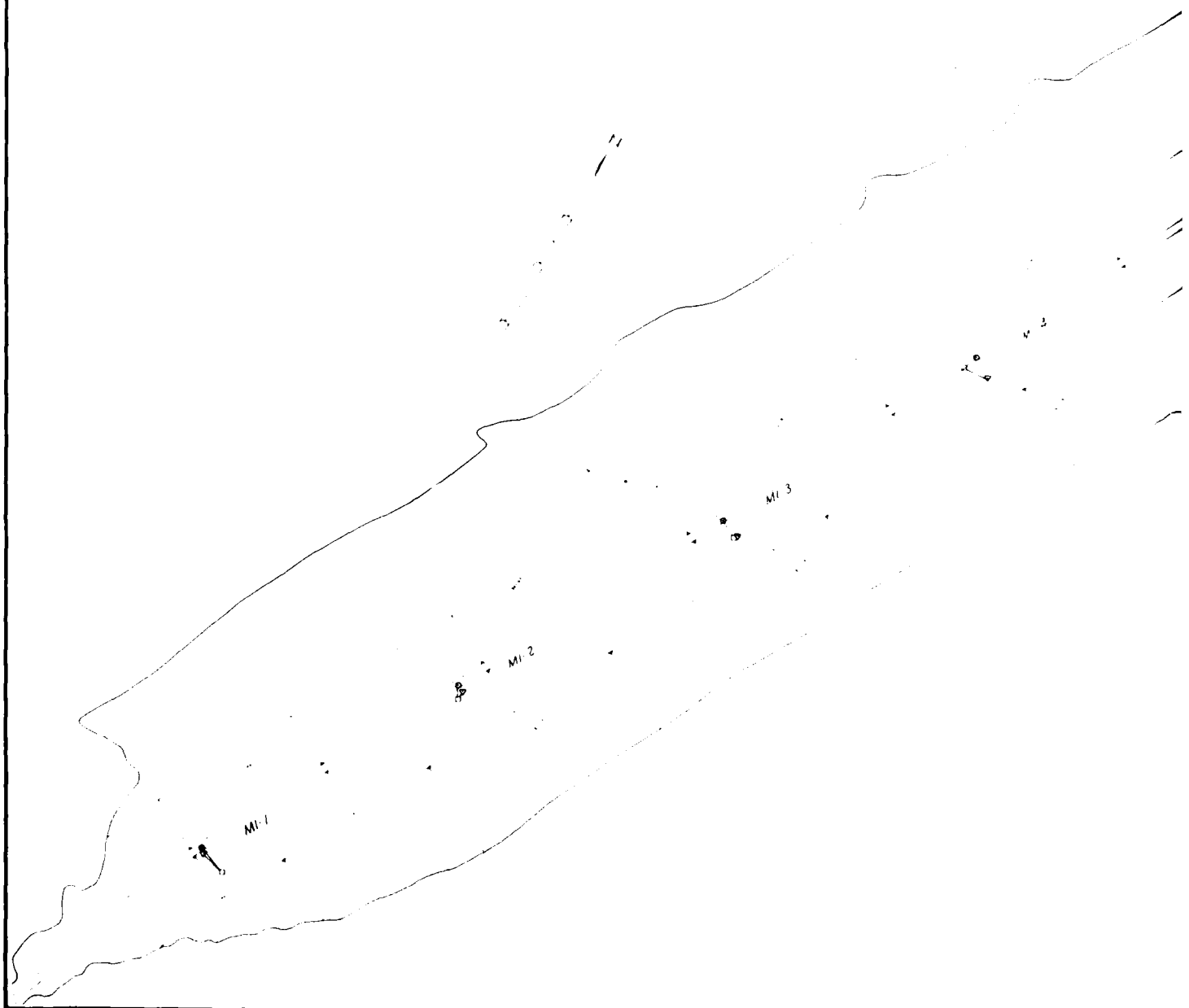


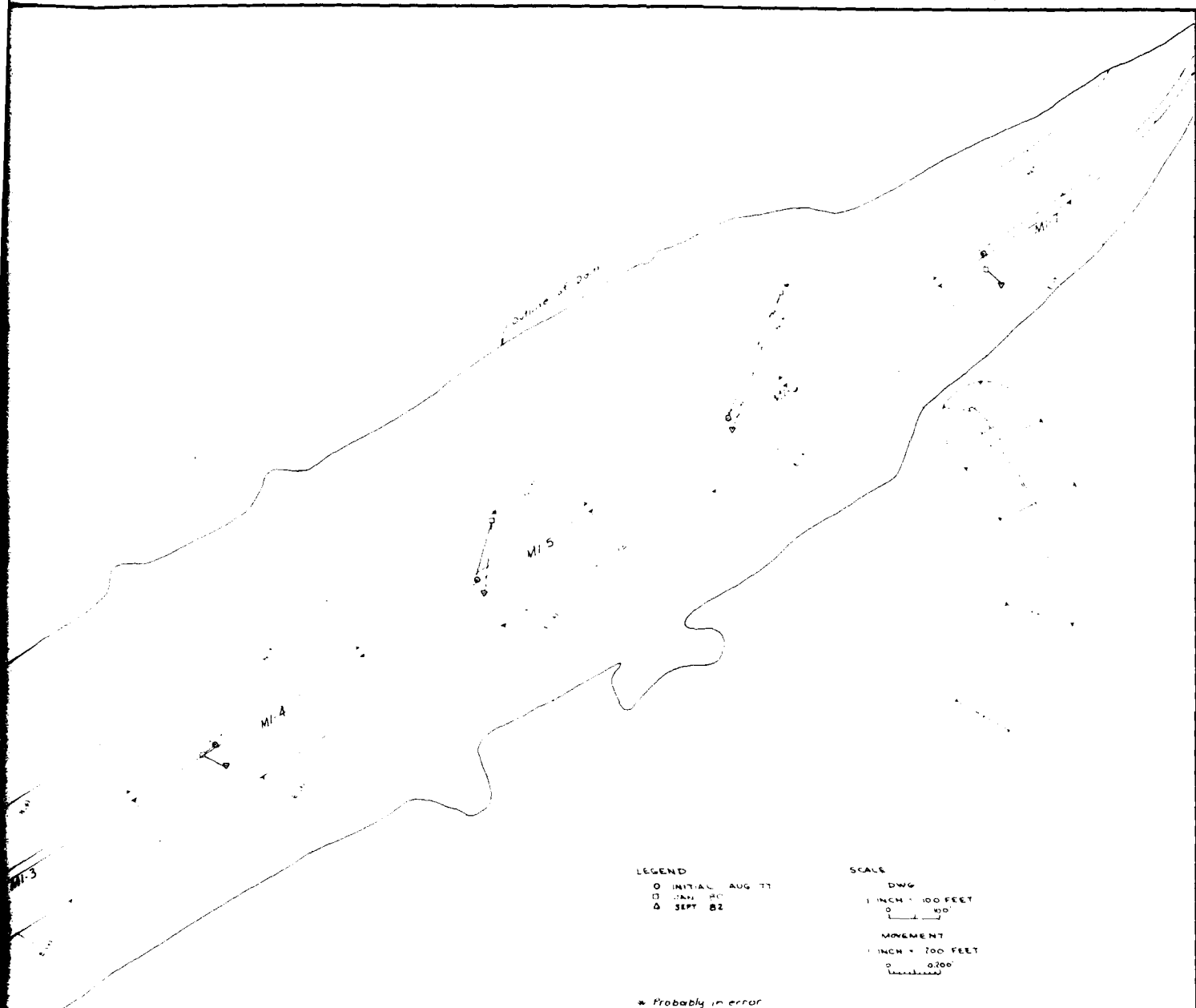
LEGEND
 ○ NOV '68
 ● MAR '69
 △ MAY '70
 □ JULY '71
 ○ MAR '72
 ● JUNE '73
 ○ AUG '74
 ■ AUG '75
 ▲ JUL '77



DATE		REVISION		DATE	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY	SACT CREEK AND ITS TRIBUTARIES, NEBRASKA				
DRAWN BY	BRANCHED OAK DAM & RESERVOIR				
CHECKED BY	CREST MOVEMENT				
APPROVED BY	LONGITUDINAL, TRANSVERSE / VERTICAL MOVEMENT				
DATE	APPROVED	DATE	APPROVED	DATE	APPROVED
THIS PLAN ACCOMPANIES CONTRACT NO.		MODIFICATION NO.		U.S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA	

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.





LEGEND

- INITIAL AUG 77
- MAY 80
- △ SEPT 82

SCALE

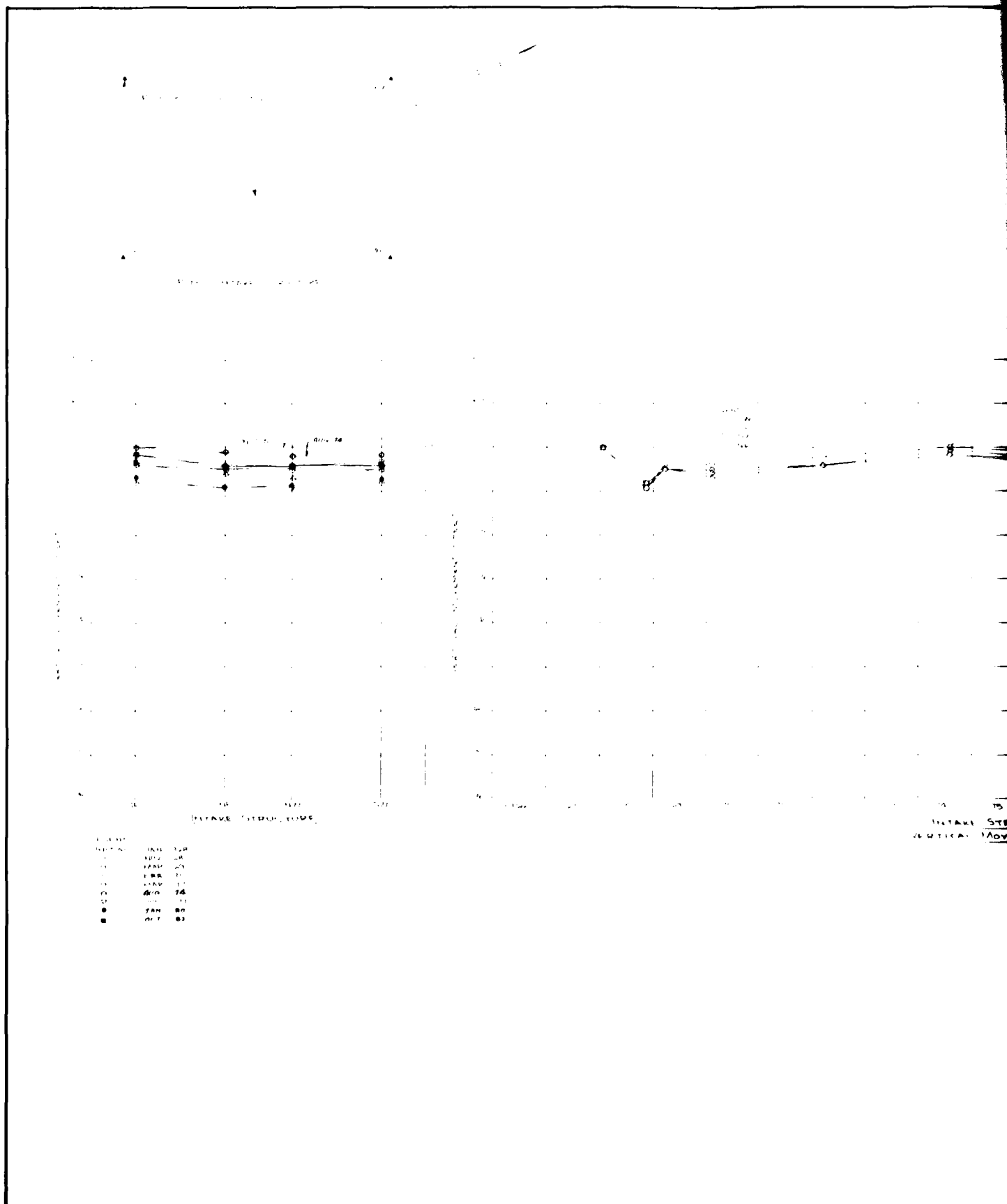
DWG
1 INCH = 100 FEET
0 100'
MOVEMENT
1 INCH = 200 FEET
0 200'

* Probably in error

DATE		DESCRIPTION		MADE	APPROV
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY	SALT CREEK AND ITS TRIBUTARIES, NEBRASKA				
DRAWN BY	BRANCHED OAK DAM				
CHECKED BY	CREST MOVEMENT MARKERS				
SUBMITTED BY	HORIZONTAL MOVEMENT				
DATE	SECTION	APPROVED	SHEET		DATE
DATE	SCALE	SHEET		SCALE AS SHOWN	SHEET NO.
APPROVED		SHEET		SHEET NO.	

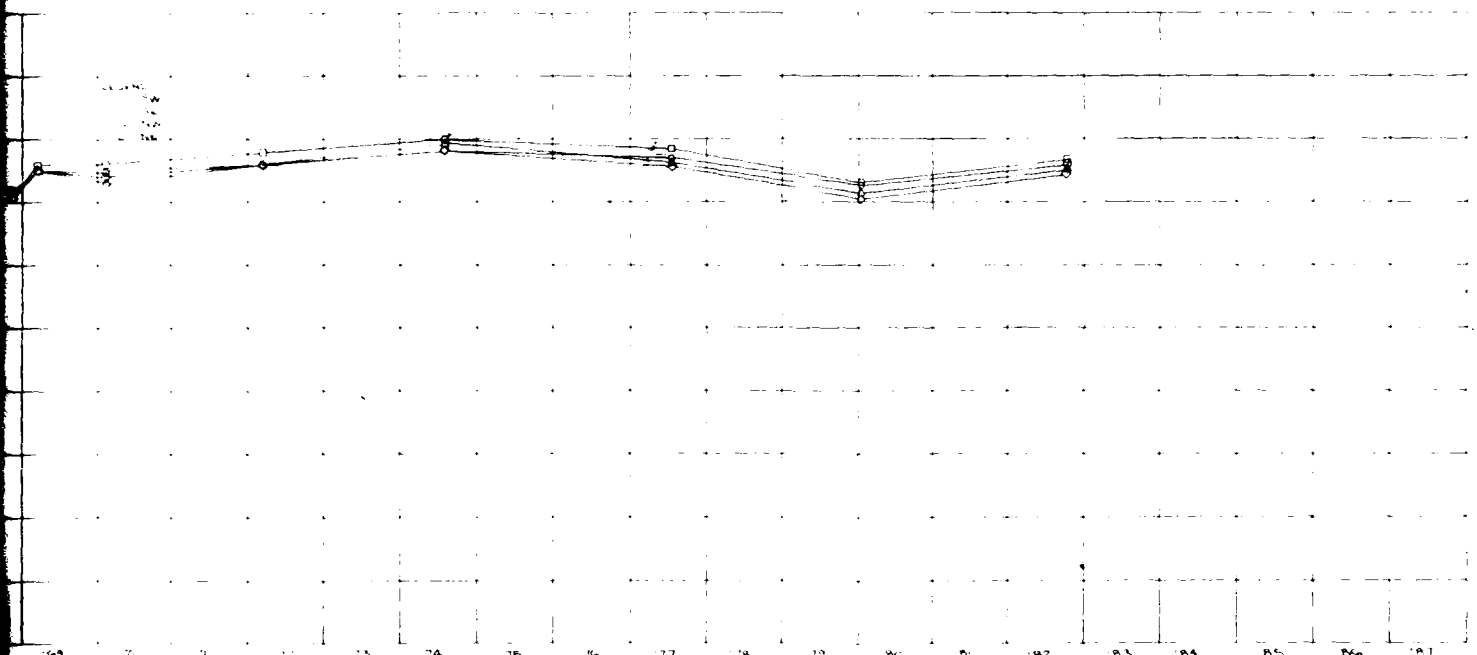


THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.



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98	1	PC
99	1	PC
100	1	PC

INTAKE ST
VERTICAL ADV

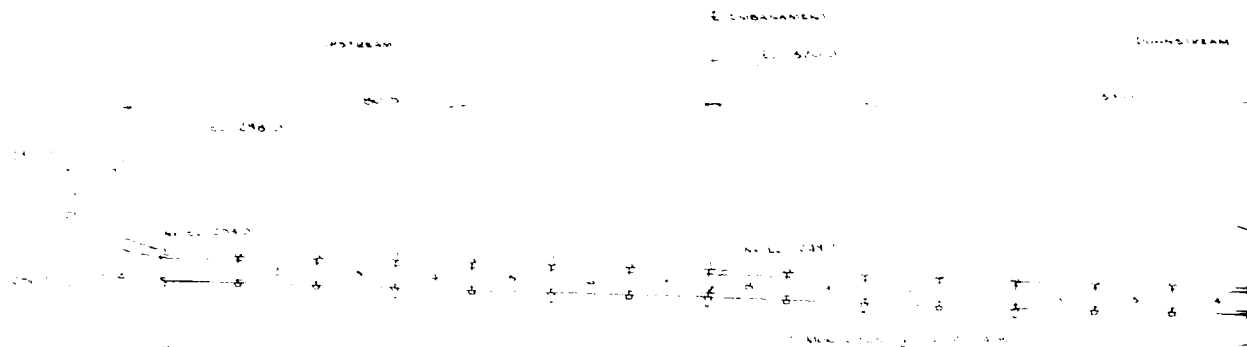


INTAKE STRUCTURE
VERTICAL MOVEMENT VS TIME

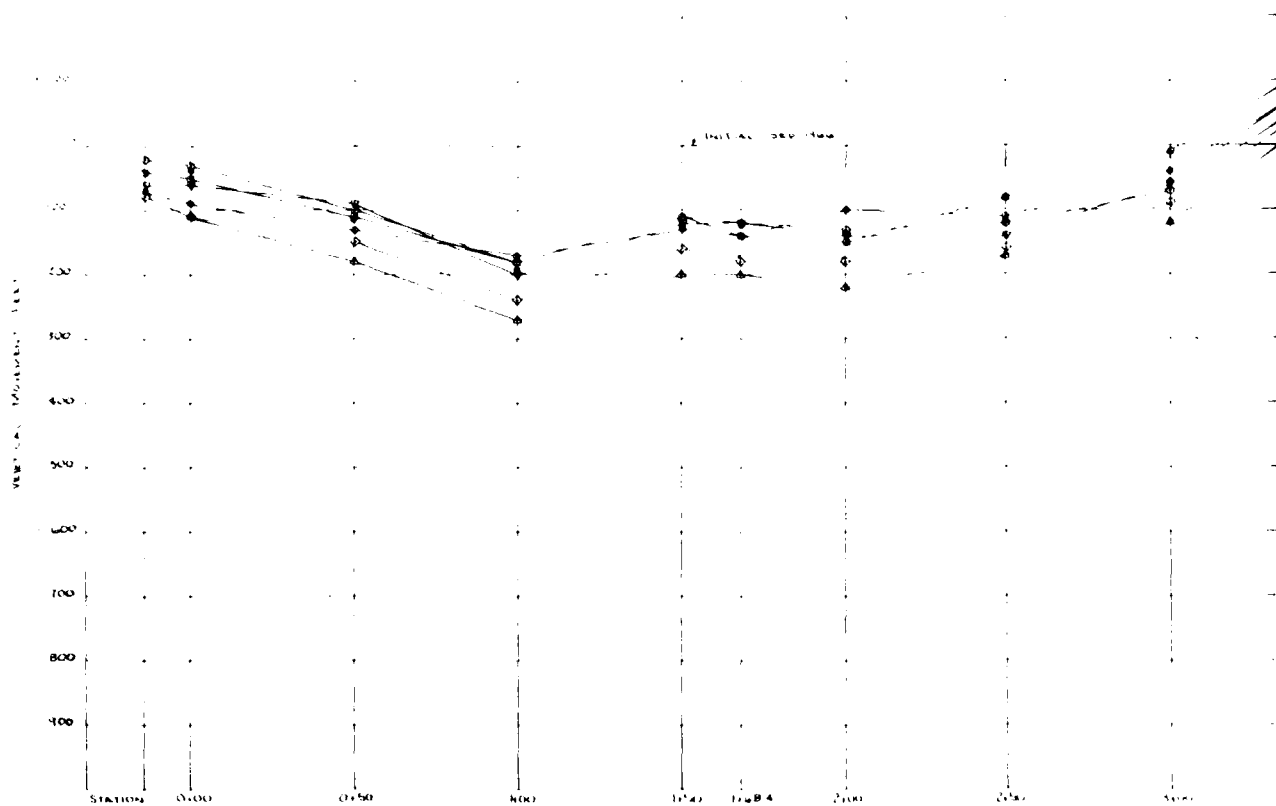


THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE		DESCRIPTION		PAGE	APPROV
REVISIONS					
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:	SALT CREEK AND ITS TRIBUTARIES NEBR				
DRAWN BY:	SITE 18				
CHECKED BY:	BRANCHED OAK DAM				
APPROVED BY:	INTAKE STRUCTURE				
DATE	APPROVED		DATE		
SCALE	SCALE		SCALE		
APPROVED	APPROVED		APPROVED		
DR. R. L. HENRY ENGINEER		DR. R. L. HENRY ENGINEER			



SECTION THREE OUTLET WORKS
WALL & MOUNTAIN STREET



DOWNSTREAM

239.0'

EL. 1265.0

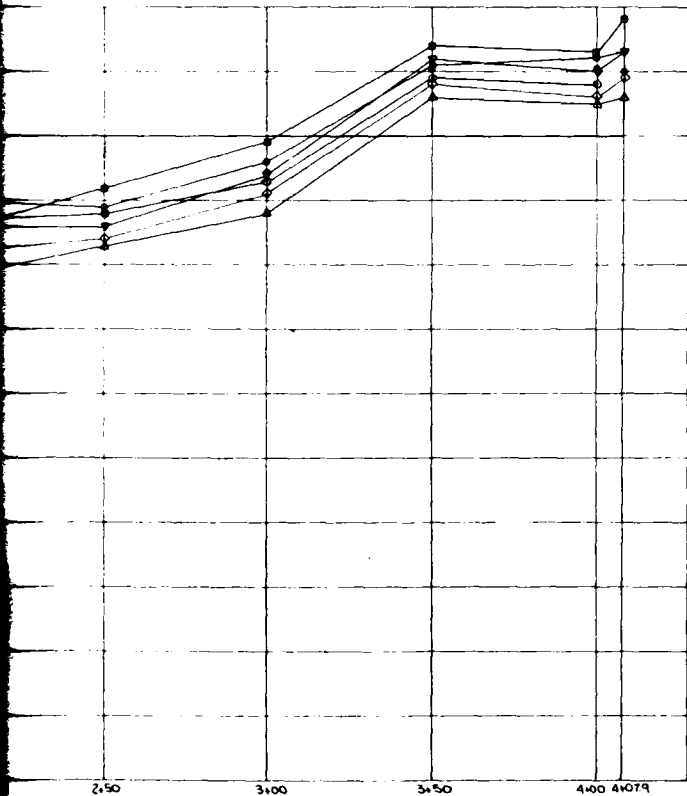
EL. 1248.0

Inv. EL. 1240.0

24" 0" 408'

SECTION THRU OUTLET WORKS

SCALE: 1 INCH = 20 FEET



LEGEND

- MAR 1967
- JAN 1968
- △ NOV 1968 (SURVEY ASSUMED TO BE IN ERROR)
- MAY 1970
- ◇ MAR 1972
- ◊ MAY 1974
- JUL 1977

NOTE
CONSTRUCTION SEP 1966 TO NOV 1967



THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

DATE		REVISIONS		DATE	APPROVED
U. S. ARMY ENGINEER DISTRICT, OMAHA CORPS OF ENGINEERS OMAHA, NEBRASKA					
DESIGNED BY:		SALT CREEK AND ITS TRIBUTARIES, NEBRASKA			
DRAWN BY: L. J. L.		BRANCHED OAK DAM & RESERVOIR			
CHECKED BY:		CONDUIT SETTLEMENT			
CONDUCTED BY:		PROFILE			
APPROVED	DATE	DATE	TO	DATE	DATE
APPROVED	DATE	DATE	TO	DATE	DATE
APPROVED	DATE	DATE	TO	DATE	DATE

EMBANKMENT CRITERIA AND PERFORMANCE REPORT (1963)

PLATE C15

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-8